SCIENTIFIC AMERICAN

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This noble building, which will cost $10,000,000, will accommodate 8,000 people and have sufficient capacity to house under one roof all the city's departments and bureaus. The foundations, costing $1,443,000, are the deepest in the world, extending to a maximum depth of 144 feet below the curb. The tower is 560 feet high.

THE NEW MUNICIPAL BUILDING FOR THE CITY OF NEW YORK.—[See page 46.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, JULY 16th, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE MYTH OF THE AEROPLANE BOMB.

THE SCIENTIFIC AMERICAN has no wish to depreciate the skill shown by Curtiss in successfully dropping imitation bombs within an area which represented the deck of a battleship; but in the interests of truth and cold logic, we feel compelled to give it as our opinion that, so far as the future of naval warfare is concerned, this dexterous feat of the aviator has but little significance.

It was inevitable, when an art so difficult and seemingly impossible as that of human flight had once been demonstrated, that the enthusiasm of its votaries would carry them into the fields of wild speculation and prophecy, and that each initial success, however modest, would be taken as proving to a demonstration many a difficult problem, whose practical solution could be arrived at by only the well-beaten road of experiment and accumulated experience.

Now, of all the bewildering tasks which, by common consent, seem to have been assigned to the aeroplane—the most sensitive, delicate, and, in its manipulation, at least, by far the most difficult means of human locomotion—that of dropping missiles from the air with such accuracy as to hit an object lying at least a thousand feet below, is by long odds the most difficult of accomplishment.

To hit a battleship with aeroplane bombs, even if they be let go from the perfected flyer of the future, is a problem most complicated. We do not hesitate to say that to take accurate aim from a safe height, clear of shrapnel fire, would involve such very accurate data and such complicated calculations of height, speed of aeroplane, speed of ship, speed of falling shell, wind velocity, direction of aeroplane flight, etc., and the shell if it did strike home would do such insignificant damage, that to affirm that the aeroplane is going to "revolutionize" the naval warfare of the future is to be guilty of the wildest exaggeration.

Far be it from us to deny that the vision of a fleet of aeroplanes sweeping like a cloud of mosquitoes above the doomed fleet of the enemy, and dropping a rain of deadly bombs into the very vitals of a fleet of cumbersome and costly battleships, which lies below utterly incapable of defense, is a picture altogether dramatic and awe-inspiring; but we cannot forget that outside of the question of the ability of the aeroplane to hit a battleship with some form of high explosive missile, there lies the fundamental fact that attack by high explosives falling out of the heavens has already, in the test of actual warfare, been proved to be very disappointing in the amount of damage which it is able to effect.

The siege of Port Arthur has not moved so far back among the pages of history, but that the public in general will remember how the Japanese, planting their mortar batteries three miles back from the city, proceeded to sink the Russian Port Arthur fleet which lay huddled, supine and useless, within the harbor. They will remember that the Japanese having captured 203 Meter Hill, by observation and telephone directed the fire of the mortar batteries upon the ships with deadly accuracy. Day after day, high explosive armor-piercing shells, weighing 500 pounds apiece (which is about equal to the weight of some of the present aeroplanes) were hurled high into the air and fell almost vertically upon the Russian battleships, which, one by one, apparently succumbed to the attack and sank to the bottom. It was naturally supposed that these huge, high-explosive missiles had either passed entirely through the ships, or, bursting within, had torn asunder the shell plating and opened a way for the inrushing water.

At the close of the war, the Japanese raised these vessels, and of course, made a very careful examination to determine what damage this vertical or "high-angle" fire, as it is technically called, had done. To the great surprise both of themselves and the whole naval and military world, it was found that the majority of the battleships had survived the impact of the falling projectiles with remarkably little damage of a critical character, and that the ships had been sunk, not by the Japanese fire, but by the Russians themselves, who had opened the seacocks for that purpose. In the majority of cases, when a hit was made, the first impact, say against a wooden upper deck, a stanchion, a companionway, etc., would burst the shell, and the damage, never vital in character, would be confined to that particular deck. The steel, protective deck was rarely penetrated; and in only one case, if we remember rightly, were the vitals seriously injured.

Applying these facts to the proposed bombardment from aeroplanes, we can see how the comparative failure of the Japanese shells settles once and for all the question of the possibility of sinking or vitally wounding battleships by little "bombs," let go haphazard from a swaying and swift-moving object a thousand or more feet in mid-air. If a 500-pound high-explosive shell, falling from a height of about two miles, failed to pass through or seriously disable a battleship, how little can be expected of Lilliputian shells, dropped from one-tenth of that height and with not one-tenth of the accuracy of aim, should they happen to make a lucky hit.

No; we cannot believe that the aeroplane is destined to "revolutionize" naval warfare of the future.

Another consideration—to aim a bomb from a moving airship, a thousand feet above the object, would involve an accurate and instant knowledge of many conditions, each of which would have its bearing upon the line of flight of the projectile. In the first place, the shell would not drop vertically, but on a curved resultant line, made up of the forward velocity imparted to the shell by the moving aeroplane and the vertical velocity due to the acceleration of gravity. The shell must be let go at a predetermined distance ahead of the object below, and the aviator must know with a reasonable degree of accuracy the following facts: The height above the object to be struck, the forward velocity of his aeroplane, the velocity and direction of motion of the ship below, the velocity and direction of the wind. He must not only know his horizontal distance from a vertical drawn through the ship, but he must be able to ascertain whether his line of flight would pass through that vertical. In other words, if he were not steering straight for the ship at the time he lets go, the shell, although correctly aimed and timed for the horizontal distance between him and the mark, would fall in a plane which would cause it to drop either to right or left of the object.

But by what means is the aviator to gather these many data, translate them into a final result, and drop his shell at the one critical instant of time that would insure a hit? The problem would be serious were he seated quietly at a desk on shore. By what magic, then, shall he work it out when he is winging it, a thousand or fifteen hundred feet in mid-air, with the roar and scream of the bursting shrapnel about him?

GIOVANNI SCHIAPARELLI.

WITH Giovanni Schiaparelli, the former director of the Milan Observatory, there has passed away one of the most brilliant astronomical observers of modern times, a man whose name has perhaps been associated with more controverted points in modern stellar investigation than that of any astronomer of our time.

It was Schiaparelli who was responsible for that more or less acrimonious controversy which has been raging about the planet Mars for over a generation, and which has been kept alive by Prof. Percival Lowell of this country, who may well be regarded as Schiaparelli's staunchest adherent. Before Schiaparelli began his epoch-making Martian investigations, the polar caps of Mars, the Hour-Glass Sea, and a few dark patches were the only surface markings known on Mars. The memorable opposition of September 5th, 1877, brought fame to Schiaparelli. While executing a trigonometrical survey, the first attempted, of the disk, then of the unusual size of 25 seconds across, Schiaparelli detected a novel and curious feature. What had previously been taken for Martian continents resolved themselves into agglomerations of islands, separated from each other by a network of lines which Schiaparelli described as "canali," which in English may be rendered more properly as "channels" than the more popular "canals." The existence of these fine lines was hotly disputed by almost every astronomer of eminence, which may be explained by the circumstance that in the wonderfully clear atmosphere of Milan, Schiaparelli was able to note a mass of detail hidden to the eyes of astronomers in the cloudier North. For years Schiaparelli's discovery was repudiated and the "canals" regarded as optical illusions. Not until several canals were independently traced out by Burton, not until Lowell multiplied them almost indefinitely, not until they were eventually recognized at Lick Observatory were they accepted as objective phenomena.

Between December, 1881, and February, 1882, the aspect of Mars was again studied by Schiaparelli, with the result that he announced not only that the canals were still there, but that in as many as twenty cases they were seen in duplicate. In other words, a twin canal ran parallel to the original one at an interval of 200 to 400 miles. If the astronomical world was loth to accept single canals, its protests at double canals can be imagined. Even now the actual "gemination," as the phenomenon is called, is disputed, and it requires all the argumentative energy of Prof. Lowell in this country to uphold it. It must certainly be confessed that this doubling is an almost unsolvable enigma. That it exists seems fairly certain, since Perrotin, Thollon, A. Stanley Williams, the Lick observers, and Prof. Lowell are united on the point. Various conjectures have been hazarded in explanation of this most curious of Martian occurrences. It was not unnatural that the difficulty of conceiving a physical reality corresponding with it suggested optical explanations. Proctor regarded the gemination as an effect of diffraction, and Stanislas Meunier of oblique reflection from overlying mist banks. Flammarion thought that the canals might, under special circumstances, be evoked by reflection as a kind of mirage. None of these explanations can really be accepted. Prof. Lowell attributes the doubling in part to vegetal causes.

Although Schiaparelli's name will, no doubt, be more popularly linked with the planet Mars, he has done other work of enduring character. In his sustained study of the features of Mercury, Schroeter had no peer until Schiaparelli took up the task at Milan in 1882. Schiaparelli's observations were made in daylight. A notable discovery ensued. Following the planet hour by hour, instead of making necessarily brief inspections at intervals of about a day, it was found that the markings, faintly visible, remained sensibly fixed. After long, patient watching, Schiaparelli reached the conclusion that Mercury turns on its axis in the same time needed to complete a revolution in his orbit, as in the case of the Moon. Hence, Mercury must always present the same face to the Sun. To Schiaparelli's eye, Mercury appeared as a spotted globe enveloped in a tolerably dense atmosphere. The marks are not always equally well seen, and disappear regularly near the limb. Following in Schiaparelli's footsteps, Prof. Lowell observed Mercury in the full glare of noon, and executed, as a result, a remarkable series of drawings which amply confirmed Schiaparelli's work, and fixed the rotation of Mercury at 88 days.

Schiaparelli's study of the planet Venus gave rise to a controversy almost as bitter as that in the case of Mars. It came with a shock of surprise when Schiaparelli announced in 1890 that Venus probably rotates after the fashion of Mercury and the Moon. A continuous series of observations from November, 1877, to February, 1878, with their records in above one hundred drawings, supplied the chief part of the data upon which he based his conclusions. Observations made in 1895 gave additional support to Schiaparelli's view that Venus rotates on her axis in the period of her revolution about the sun (225 days). Perrotin at Nice and Lowell at Flagstaff gathered data that amply confirmed the keen-eyed Schiaparelli. Many astronomers refused to accept the theories of Schiaparelli, and have adhered to the thory of a short period of rotation. Trouvelot deduced from his own observations a period of rotation of about twenty-four hours. It is remarkable indeed that two such experienced and trustworthy observers as Schiaparelli and Trouvelot could be led to such widely differing results from their practical observations of the same object during the same period. It may be regarded as certain that the problem cannot be solved by observing markings alone, particularly if the markings should turn out to be purely atmospheric phenomena.

Schiaparelli taught us to associate meteors with comets. He took in hand the Perseid meteors of August as he found them recorded on August 9th, 10th, 11th, 1886. Treating them as a concrete mass, and assuming that their orbit was the section of a cone, he arrived at certain figures on the supposition that the conic section in question was a parabola. He had reached this stage in his researches when he suddenly discovered that his parabolic elements of the meteor group closely resembled the elliptic elements which had been obtained for the comet of 1862 (III). The general resemblance of the elements of the two orbits was too unmistakable to permit of any doubt being thrown on the fact that meteors and comets were moving in orbits identical in form. That discovery deserves to rank among the most brilliant made in modern astronomical annals.

ENGINEERING.

The hydraulic turbines at the Feather River station of the Great Western Power Company of America are considered to be the most powerful in existence. When running under a 525-foot head at 400 revolutions per minute, they are rated at 18,000 horse-power each. Under the reduced head of 420 feet, each turbine develops 14,000 horse-power.

A novel application of wireless telegraphy in the field of engineering is the installation which the Pennsylvania Railway has made for testing the usefulness of air messages for railroad operation. The mast used in the tests is located on the mountain near Altoona at an elevation of 1,655 feet above sea level. Communication has already been opened with the stations on the Atlantic coast, and also with ships at sea.

Some tests which were recently undertaken on hardened cast steel to determine the strength of the specimens when subjected to combined bending and torsion, showed that the maximum principal stress is the best criterion of strength for a brittle material when subjected to combined stress. As a rule, while the hardening did not affect the bending strength, there was an increase of 100 per cent in the torque which was necessary to bring about failure.

Traffic on the streets of Buenos Ayres, the most enterprising and up-to-date city in South America, has increased to a point at which some radical relief is necessary; and a comprehensive scheme for electrically-operated subways has been passed by the city government. The concessions have been secured by the Anglo-Argentine Tramway Companies and the tramway company of Buenos Ayres, whose headquarters are at Brussels, Belgium.

In a paper recently read before the Western Society of Civil Engineers, the bridge engineer of the C. B. & Q. Railway advocated the substitution of concrete for wood in railroad trestles, the construction consisting of concrete piles, capped with reinforced concrete stringers, and overlaid with a floor of concrete slabs. When using machine-molded concrete piles, structures of this character have been built up to a length of 250 feet at a cost of from $20 to $25 per lineal foot.

The decrease in the drawbar pull of a locomotive as the speed increases, is more rapid than is generally understood. It is estimated that a 2,000-horse-power compound locomotive of the Mallet type will exert a tractive force when it is hauling a train at a speed of five miles per hour of 150,000 pounds. At ten miles the tractive force will have fallen to 75,000 pounds; at 30 miles, it will be 25,000 pounds, and at 50 miles per hour, it will be as low as 15,000 pounds.

The German army recently carried out a maneuver to test the ability of the aeroplane for night attack. The machine started out after dark to find and attack a bivouac, consisting of a squadron of dragoons that was encamped 50 kilometers from the starting point. The enemy's camp was located by the aid of the camp fires, and the aeroplane swooped down above the sleeping soldiers and dropped several bombs into the camp. The success of the experiment is stated to have been complete.

It is gratifying to learn that the United States and Great Britain have signed a treaty which will serve to regulate the use of water for commercial purposes at Niagara Falls. According to the provisions, the New York side will be permitted to take 20,000 cubic feet from the river above the falls, and the Canadian side may divert 36,000 cubic feet. The treaty contains a provision which allows the Canadian companies to transmit and sell on the United States side at least fifty per cent of the power generated in Canada.

Special interest attached to the recent launching of the torpedo-boat destroyer "John Mayrant" at the Cramp's shipyard. She was christened by the great-great-grand-daughter of John Mayrant, who was a midshipman on the "Bonhomme Richard" during the historic fight between that vessel and the "Serapis." The "John Mayrant" is 293 feet 10½ inches long, 27 feet beam, and will draw on her trials 8 feet 4 inches. She is to make 30 knots an hour. Her armament consists of five 14-pounder, semi-automatic guns and three deck torpedo tubes.

Simultaneously with the announcement that the Mersey Dock and Harbor Board has decided to construct a huge dock suitable for liners 1,000 feet in length, comes the announcement from Liverpool that the Cunard Company is about to undertake the construction of at least one liner of 60,000 tons. The new vessel is therefore to be of the same tonnage as the White Star "Olympic" and "Titanic," but of much greater length and speed. Although the company has made no official announcement, it is admitted that a large vessel is in contemplation to take the place of the "Lucania," which was recently destroyed by fire. If any thousand-foot ship enters New York harbor, she will have to berth in South Brooklyn at the new piers twelve to eighteen hundred feet in length, belonging to the city.

AERONAUTICS.

The 1910 Rheims aviation meet occurred last week. The great strides that have been made in less than a year were shown by the new records that were made, while the popularity of aviation was evidenced by the report that on the opening day fifteen aeroplanes were flying simultaneously. An account of this meet appears upon page 47.

Mr. Clifford B. Harmon made a new American amateur record for sustained flight on July 3rd. Mr. Harmon remained aloft 2 hours and 3 minutes in his Farman biplane above the aerodrome at Mineola, L. I. He intends shortly to attempt a cross-country flight above Long Island Sound. He will start from Mineola and fly to his residence near Greenwich, Conn.

The North German Lloyd steamer "Mainz," which has been chartered for the Zeppelin preliminary expedition to the North Pole, started on the 25th of June for Kiel in order to pick up Prince Henry and Count Zeppelin. On the 27th of the month, the "Mainz" steamed off for a two months' trip to Spitzbergen. The Zeppelin Polar Air Ship Company finds great difficulty in carrying out its project, largely because it seems to be impossible to obtain an auxiliary steamer stout enough to fight the ice.

Thaddeus Robl, once a bicycle rider, but latterly an aviator, came to a violent end on June 18th at Stettin. He was the victim of a crowd's clamor. A sharp east wind was blowing, and Robl was urged by the members of the Pomeranian Society for Aviation not to make an ascent The crowd proved so insistent, however, that shortly after 7 o'clock he rose to a height of 350 feet and circled round twice. Dropping from this height to within 50 feet of the ground, he sharply turned up his elevator, so that his machine would rise again. The rudder failed to respond quickly enough, and the machine was dashed to the ground with frightful force.

The Budapest aviation meet seems not to have been a brilliant success, either financially or aeronautically. During the first days at least, the spectators were not as numerous as had been hoped. The number of accidents was remarkable. Frey, caught in the wake of Illner's monoplane, was driven against a stand and smashed his machine, almost creating a panic. Three persons were seriously, and seven slightly injured. Frey himself escaped with a whole skin. Illner, Latham, Efimoff, Chavez, and Bjelovuzi also met with accidents, and were more or less injured. In every case their machines, however, were total wrecks. The Frenchmen made the poorest showing, largely because they were waiting for favorable weather conditions. They had nothing to lose by waiting, for they were each guaranteed 50,000 francs and traveling expenses.

On the opening day of the Rheims meet Wachter fell to his death in his Antionette monoplane owing to the wings breaking off while he was at a height of 500 feet. Details of this accident are not yet available, but according to cable dispatches both wings broke completely off the body and fluttered down to earth behind it. The boat-shaped body, with the heavy 50 horse-power motor in its bow, naturally dropped to earth at a terrific pace, the unlucky aviator being instantly killed. While a comparatively new aviator, Wachter had nevertheless made many excellent flights. On May 15th he remained aloft 2 hours and 2 minutes. Wachter is the second pilot of an Antoinette monoplane to lose his life recently, the other being young Hauvette Michelin, who was killed May 13th at Lyons by the falling of one of the pylons used to mark the course when the monoplane hit it while running along on the ground.

A second accident occurred last Friday at the Rheims meet, when the Baroness de Laroche became confused as two aeroplanes were passing her Voisin biplane. Stopping her motor, she attempted to glide to the ground. In a swift descent from a height of 200 feet the biplane upset. The aviatress was very badly injured, but it is hoped she will survive.

Aeroplane accidents seem to multiply. They serve the useful purpose of indicating defects in the machines of the present day, and showing where improvement must be made. Dr. Lissauer of Germany ascended recently in his machine, and while under way a cylinder head blew off. Fortunately, he came down without injury. Otto Lindpaintner, the well-known Munich aviator, ascended with Countess Edeltrud von Bopp, and almost killed himself and his passenger, for a propeller struck a loose guy-wire and was splintered. Fortunately, Lindpaintner succeeded in descending before the propeller was entirely broken. Lindpaintner went up a little later with the injured propeller, but came down again in four minutes. His left wheel buried itself in soft ground, and the machine, which was still in circular motion, was upset and wrecked. Lindpaintner emerged from the wreckage safe. He is also said to have caused the accident to Baroness de Laroche, as he passed over her and the air wash from his propeller may have caused her descent.

SCIENCE.

Knud Rasmussen is preparing an expedition at Cape York which will be sent northward to study the American Eskimos. Rasmussen expects to be away for two years.

In the death of Prof. Cyrus Thomas the United States has lost one of its most eminent authorities on the history of the North American Indians. Prof. Thomas was connected for many years with the Bureau of Ethnology of the Smithsonian Institution.

The American process of reducing milk to a powder has now been introduced into Norway. One of the new companies formed has contracted to deliver 300 tons of dry milk each year for three years to an English firm. The dry milk is used largely for invalids and convalescents, on ships on long voyages, because of its keeping qualities under all climatic conditions and its convenience of transportation.

How two stereoscopic pictures on one plate can be made has been revealed by E. Estanave. He shows that when the grating placed in front of the photographic plate has horizontal lines as well as vertical ones, suitable exposure through an objective with four apertures at the corners of a square give the necessary elements from which are obtained two different stereoscopic pictures on the one plate.

Another remarkable alloy has appeared in Germany, called Ruebel bronze, after its inventor, Walter Ruebel. Its main ingredient is magnesium, to which zinc, copper and aluminium are added. A fine-grained homogeneous alloy of considerable strength and no specific gravity is thus obtained. This new alloy is important in constructing airships. The Zeppelin airship, with its mechanical parts of the new metal, would weigh 3½ to 4 tons less than at present constructed.

In connection with the explorations which are being carried on in the old cemetery of the church of St. Seurin at Bordeaux, a vessel of green glass, containing a quantity of lees, or incrustations, was found in a sarcophagus which appeared to date from the first century of the Christian era. The deposit has been analyzed, and the results lead to the conclusion that the vessel originally contained wine, the evaporation of which has left traces of chromotannic matter, more or less covered with carbonate of lime, and which has also deposited very sharply defined and characteristic grains of cream of tartar.

In Sprechsaal Hans Fleissner applies Brücke's report on the colors of dimmed mediums to dimmed glass which looks reddish-yellow when held toward the light, but blue if viewed in reflected light. The formation of the dim medium in the glass is due to partial devitrification. The light-dimming particles have not yet reached the size required to prevent the appearance of the blue color, so that a chromatic decomposition of white light can take place. Upon the further progress of devitrification, the blue color disappears and the glass becomes quite dim and white. The author suggests the possibility of utilizing this phenomenon industrially.

Lest it be thought that the recent experiments made from the Eiffel Tower, to transmit by wireless telegraphy time to ships at sea, are the first of their kind, be it said that in 1904-05 Albrecht showed that it was possible to utilize wireless telegraphy for the transmission of time signals in the determination of terrestrial longitudes. In 1906 E. Guyon found it possible to work between Paris and Brest by the method of telephonic coincidences with an accuracy of 0.003 sec. under good conditions. With an apparatus installed between the observatories of Paris and Montsouris, a series of comparisons were made between the results given by telephonic and radiotelegraphic transmission, and the probable errors show the mean error of a comparison to be about ± 0.0006 sec. A set of pendulums with special silver contacts were employed to work the sparking apparatus for the wireless signals.

The ears of gunners are often seriously injured by the detonation of great guns, the tympanum of the ear being frequently ruptured. Mariotti has invented a simple device which prevents these injurious effects, without diminishing the sharpness of hearing. The protector consists of a solid mass of glass of such form as to fit accurately the external ear, into which it is inserted. It is traversed horizontally by a perforation, the inner end of which almost touches the tympanum. The outer end of this horizontal passage does not quite reach the outer end of the mass of glass, but connects with a vertical passage which communicates freely with the atmosphere above and below. The violent disturbance of the air caused by the artillery discharge produces an aspiration in the horizontal passage, and consequently a rarefaction of the small mass of air confined between the tympanum and the glass protector. In consequence of this rarefaction, the force of the aerial vibration transmitted to the tympanum is very greatly reduced. This effect is produced only by violent compressions of the atmosphere, so that the sensitiveness of the ear for ordinary sounds is not diminished.

RADIUM COLLECTOR FOR ELECTRICITY

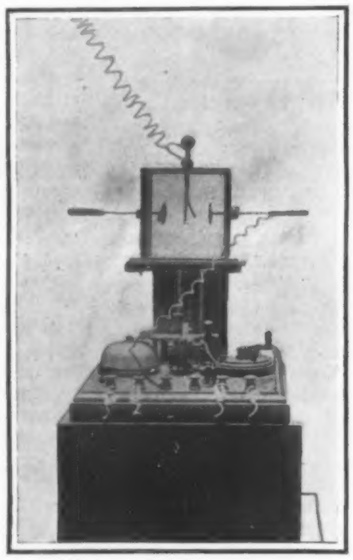
BY OUR ENGLISH CORRESPONDENT

An interesting and highly efficient apparatus for use in collecting electricity from the atmosphere, which has many great advantages over the old familiar flame collector, has been invented by a well-known English scientist, Mr. F. Harrison Glew, whose work in connection with Roentgen rays and radium phenomena is well known. In view of the remarkable ionizing properties possessed by radium, this experimenter evolved a simple apparatus whereby atmospheric electricity can be collected, and the device is of such a character that it can be used either for the purposes of lecture demonstrations, or for meteorological observations in connection with recording appliances.

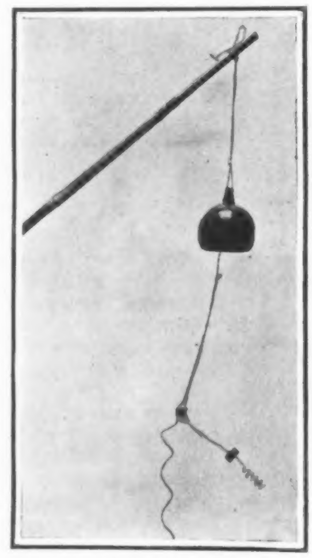
The main difficulty that had to be overcome in the use of radium for this purpose was the elaboration of some means of rendering it absolutely stable under exposure to all and varying climatic conditions, so that it would require no special care or suffer deterioration in use. In this direction he finally succeeded by the preparation of salts of radium in an insoluble form.

A thin, short metallic conductor of spiral shape is coated with this preparation, and this conductor is of such a nature that it does not suffer from corrosion upon exposure to the destructive forces present in the atmosphere. The conductor is attached to a cap, so that it can be easily and readily slipped into a protective glass cylinder when not in use.

The collector is then suspended from a special type of insulator, so as to insure the electricity to which it is attached. An ordinary type of insulator was found unsuitable for this purpose, as the deposit of carbon particles from the air, especially in towns and cities, in a short time established a bridge between the opposite ends of the insulator, and set up a leakage to the earth. The insulator he has devised overcomes this defect in a complete manner. There is a hollow semi-spherical cup of insulating material such as vulcanite, the polish on which does not offer a ready surface of adhesion to



The collector sleve attached to electroscope, showing leaf discharging and ringing electric bell.



The radium collector of metallic spiral coated with insoluble salts of radium, suspended from a novel type of insulator.

RADIUM COLLECTOR FOR ELECTRICITY.

the carbon particles. Into the dome of this cup is screwed a stub of another kind of insulating material. The wire or string by means of which the collector is suspended at any desired height is fixed to the outside upper end of this stub, and the wire carrying the collector itself is attached to the stub end within the cup, which is inverted. In this manner it is practically impossible for a short circuit to result, as the bridge of carbon particles would have to be deposited upon both the inner and outer surfaces of the cup between the two ends of the stub.

The collector can be set up in any convenient position, such as from the extremity of a fishing rod, thrust out of a window, hung from a cross-piece on a flagstaff, or from a kite or a balloon. The collector is connected in a suitable manner with a fine wire from the insulator, and carried to an electroscope which likewise can be set up wherever convenient.

The radium acts by ionizing the air in its vicinity; a result which quickly takes place, so that the aerial acquires the potential of its elevation. According to the electrical conditions of the atmosphere around the collector, the electroscope discharges automatically to the earth, with great frequency or at relatively long intervals. If the electroscope be of small capacity, the slightest variations are observable at all times. Sometimes the discharges will be very gradual and slow, the movement of the leaf being scarcely perceptible. At others, especially during a thunderstorm, when the air is very heavily charged with electricity, the leaf kicks fiercely, the discharges coming in very rapid succession.

For ordinary demonstration purposes the collector and the electroscope suffice, but it is possible to carry out a number of other interesting experiments if additional apparatus be used, while in connection with meteorological observations a continuous record of the electrical condition of the atmosphere day and night can be secured. In our illustration the col-

(*Concluded on page 57.*)

INSTRUMENT FOR SOLVING PROBLEMS OF NAVIGATION

Few landsmen realize the complete isolation of a vessel at sea. The visible world about it is so small. Even the lookout in the crow's nest 100 to 120 feet above the water can only see from 10 to 12 miles of the course before him, and a circle 25 miles in diameter would show as a mere speck no larger than a pinhead on a five-foot map of the world. Creeping about the great bald dome of the earth, the navigator has no means of determining his course and progress unless he looks to the heavens above. While he can see only about one four-hundred-thousandth part of the globe he is sailing upon, he can see a half, and even a trifle more than a half, of the heavens surrounding the earth. The heavenly bodies all appear to be equally distant from him, and for the sake of convenience, the heavens are imagined as a great hollow sphere with its concave surface studded with stars, while the sun, moon, and planets move along paths that are traced on the same concave surface.

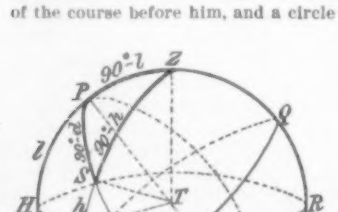


Fig. 1.—DETERMINATION OF LOCAL TIME.

The navigator has marked this celestial sphere with imaginary reference points and lines which are projections of the geographical lines on our earth. There are the celestial poles, the celestial equator, the declination circles corresponding to our parallels of latitude, and the meridian or hour circles, which pass through the poles like our circles of longitude. The navigator's problem, then, is to project his own position on the celestial sphere, that is, to locate the point immediately overhead; and this is not so easy as one might imagine. The problem is complicated by the fact that the earth is revolving on its axis, and the overhead spot or zenith is constantly sweeping around the heavens eastward in a circle parallel to the celestial equator. Evidently, the time of day when the observation is taken makes a great difference in the location of this spot along the circle. It is necessary then to determine the local time; and once this is known, the navigator compares it with his chronometer, which keeps accurate time of Greenwich or some other observatory. The difference between the two times gives him his hour angle, or the arc along the celestial equator between his own meridian and that of Greenwich.

In the accompanying diagram, Fig. 1, the celestial sphere is represented as a transparent globe viewed from some point without the universe. At the center of the sphere is a dot T, representing the earth, and on this dot directly under the point Z is a vessel whose captain is endeavoring to find his bearings. He can see all the celestial sphere above the circle HAR, which is his horizon. The celestial poles are represented at P and D, and the celestial equator by the circle EOQ, while $HPZR$ represents the meridian of the ship. The sun or body upon which an observation is being made is indicated at S. By means of a sextant, the altitude of the sun above the horizon is found

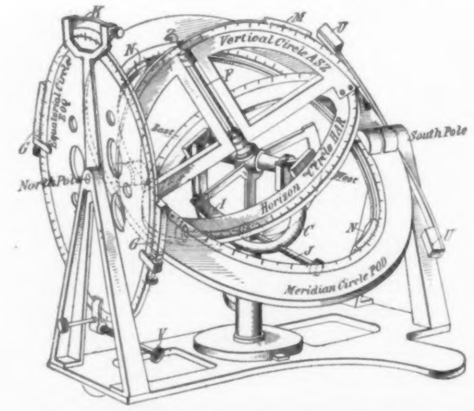


Fig. 2.—DRAWING SHOWING RELATION OF THE VARIOUS CIRCLES TO EACH OTHER.

to be h degrees. Hence the zenith distance ZS of the sun is 90 deg.—h. The navigator is assumed to have determined his latitude by previous observations, such as a measurement of the height of the sun above his horizon at noon and comparison with tables and the Nautical Almanac. Knowing the latitude l, he has the zenith distance PZ of the pole, which is 90 deg.—l. The Nautical Almanac gives him the declination d of the sun, that is, its height above the celestial horizon, and this subtracted from 90 deg. gives the third side PS, of the spherical triangle ZSP. At noon the sun will be on the ship's meridian $HPZR$. Hence the angle SPZ is the hour angle of the sun, or its angular distance from the meridian, and represents the local time. To find this angle, the navigator

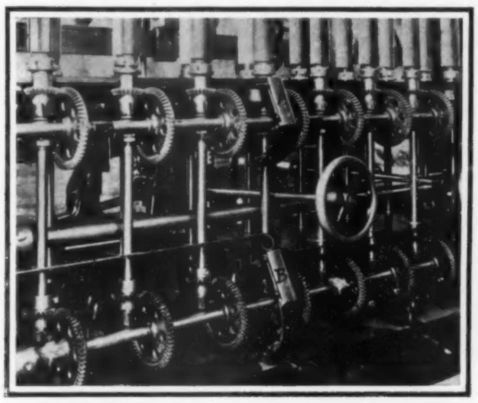
(*Continued on page 56.*)

REAR AND FRONT VIEWS OF THE MACHINE FOR SOLVING NAUTICAL PROBLEMS.

SAFETY APPLIANCES IN THE COTTON-SPINNING INDUSTRY

BY J. H. CRABTREE

The rapid progress made during recent years in the spinning of cotton has called special attention to the prevention of accidents by adequate means. Safety is the controlling and actuating force of all our energies. A workman cannot profitably spin cotton without reasonable confidence in the condition of his surroundings. And so from the very beginning of operations



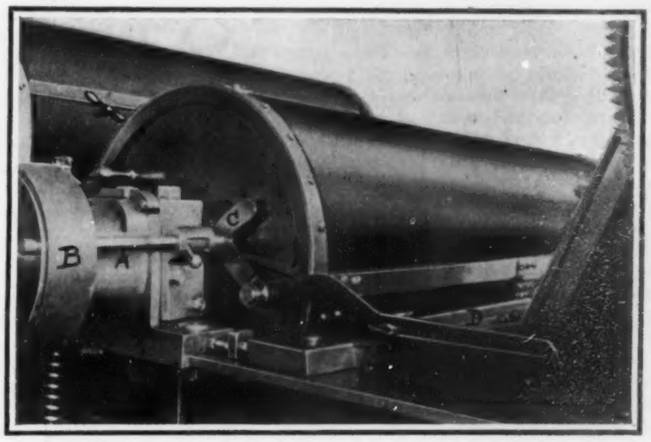
Skew bevels of the speed frame. Guard plates fit on the brackets A and B.

the new era in cotton spinning insists on safeguarding the worker, sparing his limbs, and promoting his efficiency.

When a cotton bale reaches the mill from the cotton fields of the Southern States, it is disheveled and cast upon the bale breaker. Bale breakers have been the source of disastrous accidents where able-bodied men, when feeding the machine, or removing some obstruction near the spiked rollers, have been captured, and in a few seconds maimed for the rest of their natural life. To prevent the possibility of this happening, steel grids are stretched from side to side of the lattice over a length of two to three feet, so that no hand in feeding can approach the rollers. The top of these rollers is completely covered by a wrought-iron guard. The driving wheels of a bale breaker are, when exposed, admittedly dangerous. A complete shield fits over these, thoroughly preventing any admission of the worker's fingers.

From the bale breaker the fiber passes to the lap machine, where the first roll of cotton is completed. This lap machine and the scutcher which immediately follows have dangerous points in common. The side pulleys are near the floor, and revolve at high speeds. It frequently happens that hand brushes and cleaning material become entangled in the spikes, with serious results to the workmen. Features have been disfigured and eyes destroyed by brushes flung at the operative by these flanking wheels. To guard this seat of danger, the pulleys are covered by a sheet iron fender. On the opposite flank of the machine are trains of spur wheels, where workmen have suffered severely from cleaning traps and by involuntary falls. For these wheels a cast-iron shield is provided, which can easily be removed for repairs or inspection purposes. The guard in no way detracts from the appearance or utility of the machine, and furthermore serves to keep the gearing as free as possible from dust and grit.

With lap machines and scutchers we have another difficulty, well known in every cotton mill in the States. The "beater" is a fierce mutilator of hands and fingers. Its blades are of sharpened steel, two or three on the beater shaft, and they revolve 1,000 times per minute. Occasionally accumulations of cotton lodge near the bearings of the beater shaft, and the workman is sorely tempted to lift the small door which leads to the beater chamber. The driving strap is turned on the loose pulley, and the machine is allowed to slow down for a minute or two. To all appearance it is now stationary; but no: When it is very slightly moving on the outside, the inner blades are running at a dangerous speed. If now the unwary operative puts his fingers into the chamber to remove the obstruction—a lump of cotton—these digits are lopped off instantly. Between the revolving blades and the frame of the scutcher there is scarcely an eighth of an inch. To prevent this casualty, safety appliances are provided which shut the chamber door until the beater blades are quite still. Further, the scutcher cannot be restarted, after being stopped, until the door is positively closed. One of the illustrations shows such an appliance on a Platt's scutcher. The rod *A* engages the driving pulley *B* when the scutcher is still. Then the beater chamber may be opened with impunity. The moment *A* is disengaged from the driving pulley, it slides into an aperture in the angle *C* and locks it. But this angular fitting is part of a lever, the other end of which, at *D*, holds the door latch by means of a slot. It follows, therefore, that with the

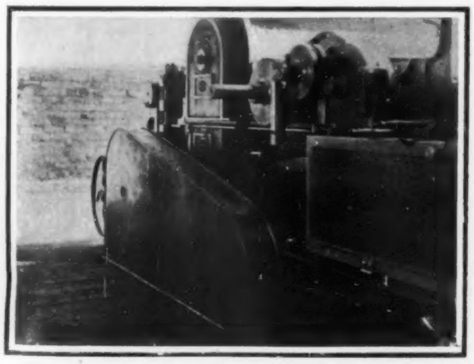


Device for keeping beater chamber closed until beater blades have come to a stop.

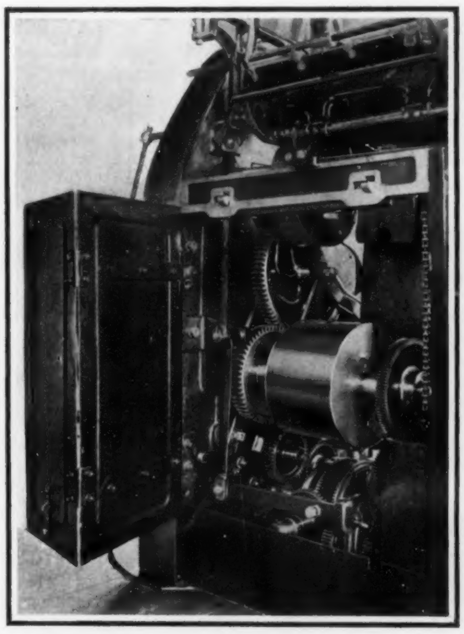
rod *A* in *C*, that is when the machine is in motion, the door cannot possibly be opened, and there can be no access to the beater blades.

From the scutcher the fleecy material is passed to the carding machine, where the fibers are cleansed of useless dirt and parts of the cotton plant, and are combed so as to assume a uniform and regular direction. The roll or "lap" of cotton is converted into a loose "thread" or sliver. The "card," as it is termed in brief, has long been known as a dangerous piece of mechanism, so much so, that the trains of spur wheels operating the taker-in, main, and doffer cylinders are provided with substantial guards. The most vulnerable, however, of all parts of the card is the main cylinder. This varies in diameter from 40 to 50 inches, revolving at 160 with a peripheral speed of 26 feet per second. The cylinder is covered with filleting, which bears thousands of steel-wire points, each turned slightly inward to hook on and capture the cotton fibers. So long as the cylinder door is closed, no risk arises. But this door, which is used for the purpose of applying the stripping (cleaning) brush, is sometimes left open inadvertently after the stripping brush is removed. The machine still runs, and a curtain of cotton is formed which conceals the uncovered part of the revolving cylinder. Here is the

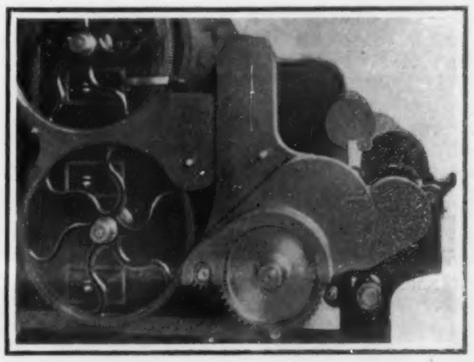
(*Continued on page 57.*)



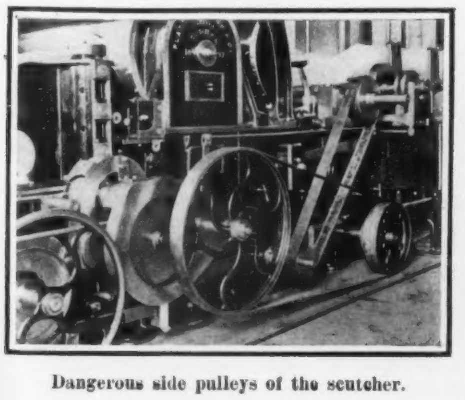
The scutcher pulleys covered by a fender.



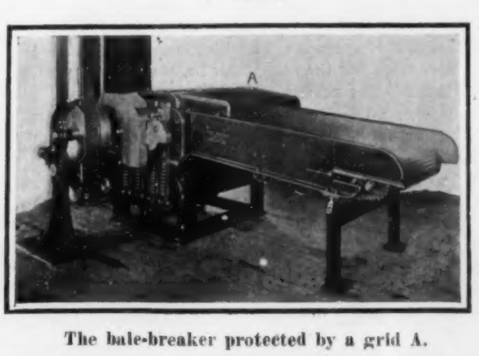
Gear wheels of the speed frame in a case that can be locked.



The gear shield over the scutcher gears.



Dangerous side pulleys of the scutcher.



The bale-breaker protected by a grid A.

The treacherous beater blades of a scutcher.

SAFETY APPLIANCES IN THE COTTON-SPINNING INDUSTRY.

A MUNICIPAL BUILDING OF THE CITY OF NEW YORK.

For many years the city of New York has suffered much inconvenience and been put to unnecessarily great additional expense because of the lack of adequate office facilities for its various departments, which have been distributed among several office buildings in this city. With a view to bringing all the departments, bureaus and various offices of the city under one roof, the magnificent building which is illustrated on the front page of this issue, is being erected near the terminus of the Brooklyn Bridge, on a large plot of land lying between Park Row and Center Street. The building will have a frontage of 381 feet on Center Street, and its total depth will be 173 feet. The plan is practically U-shaped, with the hollow of the U forming a court open on one side, the open end of the U facing the west. Chambers Street runs right through the middle of the building, and the court is closed on the western elevation by an open screen of columns, which serves the double purpose of affording a monumental entrance and of binding together the north and south wings of the building. This colonnade rises to a height of fifty or sixty feet, and is to be crowned by colossal figures. Above this surrounding colonnade rises the main wall of the building, which is treated with vertical bands. The colonnade is echoed at the top of the building by one of less height. In the main structure, which rises 337 feet above the curb, there are twenty-five floors, and from the center of the court on the eastern side an exceedingly handsome tower is carried up fifteen stories higher to a point 560 feet above the street level. This tower has been given a municipal character, that is to say, one which is in harmony with the tower of the City Hall nearby, and is of the character that has been used frequently in city halls of this country and abroad. The whole of the exterior will be covered with light gray Mount Waldo granite, and its pleasing effect, particularly in the tower, is admirably brought out in our front page engraving.

It is needless to say that this will be one of the largest office buildings in the world. In the frame alone there will be 26,000 tons of steel, and in the shell 700,000 cubic feet of granite. Each floor will contain approximately one acre of area, and 32 elevators will provide the necessary service as far as the twenty-fifth floor. The total rentable space in the whole building will be 1,250,000 square feet. It will afford ample accommodations, not only for the whole of the present departmental forces of the city, but with some adjustments, will be capable of taking care of all increases of the force for many years to come.

The Subway Station.—The main floor of the building will be entirely devoted to hallways, entrances and the subway concourses. Nine stairways varying in width from ten to fifty feet, will give access from within the building to the mezzanine floor and the station below. Additional facilities will be afforded by several entrances from the street. The station will form the terminal of two two-track subways leading down below Center Street from the Williamsburg and the Manhattan bridges, respectively. For the present there will be five platforms and four tracks within the building. Eventually, two additional tracks, the whole seven tracks being served by seven platforms, will be laid for the Manhattan Bridge service. When the present plans are developed, the Williamsburg tracks will be extended in subway down Nassau Street to a terminus at the foot of Broad Street, and the Manhattan Bridge tracks will be continued in a subway below William and Beekman streets, and will pass through a tunnel to the Borough Hall, Brooklyn, where a large new station will be built. They will be continued up Willoughby Street to the Flatbush Avenue extension, and there will connect with the Brooklyn system of subways in Lafayette Avenue and Fourth Avenue. For the present, the scheme of continuing the tracks over the Brooklyn Bridge has been abandoned.

The Costly Foundations.—From an engineering standpoint, the most interesting feature of the municipal buildings is the foundations. Because of the great height and weight of the building, it was necessary to carry the foundations for the supporting columns down to bedrock, wherever this was possible. The rock floor, however, lies at a depth of from 144 feet to 178 feet below street level. This necessitated the use of the pneumatic process in sinking the caissons. The legal limit of pressure under which the law permits excavation to be carried on is 50 pounds per square inch, which is reached at 115½ feet below tide level. The maximum depth to which any caisson has been sunk is 112 feet 1 inch, below tide level, or 144 feet below the street.

All of the caissons below the main tower and the south wing of the building, 68 in number, and varying in size from 19 by 19 feet square, to 6 feet 6 inches diameter, have been carried down to rock to an average depth below the street of 136 feet.

Over the rock floor the moraine consists mainly of a glacial drift of sand with very few boulders. To the north of the main tower below the north wing, the rock slopes steeply toward the north, reaching a maximum depth beneath the north wall of the building of 178 feet. It was impossible to reach such a depth by the pneumatic process, and therefore, it was decided to use broad concrete foundations bearing on sand, with a conservative maximum pressure of six tons per square foot, which is 25 per cent less than the maximum pressure allowed by the law. These foundations were sunk to an average depth of 72 feet below the curb.

The foundations consist of a concrete in the proportion of one of cement to two of sand and four of broken stone or gravel. They were sunk by reinforced concrete, timber, and steel working chambers, in which the men excavated the sand under pressure and passed it up through steel shafts and airlocks at the top of the casing. After the rock bottom was reached, and had been passed upon by the city's caisson inspectors, the working chamber was grouted with cement, the air pressure was taken off, and the working shaft was concreted up to the top of the pier. No cofferdams were used during the sinking operations, and the foundation piers consist of monolithic structures throughout, reinforced by steel rods, which were introduced to take up the frictional drag of the structure during the sinking operations. The same system of sinking was used for the foundations which have been laid on the sand; but whereas the load per square foot on the rock foundations is between 14 and 15 tons, the sand foundations were given sufficiently large areas to bring the unit pressure down to six tons per square foot, as mentioned above.

Not only are these foundations the deepest that have been built by the pneumatic process, but they are also the most costly, the contract price being $1,443,000. Furthermore, the City Bridge Department, which has charge of the whole building, and the contractors, The Foundation Company, are to be congratulated on the fact that in spite of the great depth, there have been but two cases of "the bends," and not a single life has been lost from caisson disease. This is due to the fact that a compressed-air hospital, with a corps of physicians has been maintained at the site, and the men who are employed as "sandhogs" are examined by the physicians and rated for work under maximum pressure according to their physical conformity with the standard. The peculiar sickness known as the "bends" is now well understood. If we fill a silk bag with air under pressure, the air will gradually leak through. When a workman comes too suddenly out of a working pressure, say, of forty pounds, the outside pressure against his body is instantly released, but the internal pressure of the air under pressure, that is distributed throughout his system, causes the blood vessels to extend and press against the nerves, causing excruciating pain. The patient is placed in a room where the pressure is raised to that under which the man has been working, and then a small valve is opened which allows the pressure in the room to fall very gradually until, at the end of a few hours, it is at normal, and there is equilibrium between the external air and that within the body of the patient.

We have stated above that the foundation will cost $1,443,000. The cost of the superstructure will be $5,895,000, and the whole building as finally completed and equipped will have cost about $10,000,000. It is estimated that it will house some 8,000 people.

The Current Supplement.

In the opening article of the current Supplement, No. 1802, the many animals which are protected from attacks of their natural enemies by quills or spins are described and illustrated.—Dr. Philip Schidrowitz's excellent summary of the India rubber industry is concluded.—Of all parts of Paris, the Place de l'Opéra has suffered longest from the work of constructing the subway system of the Metropolitan Railway of Paris. The great complexity of the task is described and pictorially represented.—There seems to be a general complaint from engineers regarding the lack of information covering the time required to reverse an electric motor. This problem is admirably handled by Mr. J. S. McKee.—George Westinghouse's paper on the electrification of railways, in which he points out the imperative need for the selection of a standard system, is concluded.—The need in shipyards for a machine to cut square or mitered the various channels and angles required for shipbuilding purposes, has been met by a machine which is described by the English correspondent.—The Paris correspondent writes on a new system of wireless telegraphy, namely, that devised by Bellini and Tosi.—Under the title of "The Cheapest Form of Light," the late Prof. Langley published nearly twenty years ago a photometric and bolometric study of a Cuban firefly. Drs. H. E. Ives and W. W. Coblentz have checked up his investigations with American fireflies of the species common in Washington. Their results are presented.—C. E. Munroe and Clarence Hall discourse instructively on mining coal with explosives.—In all ages, one's first impression as to the number of the stars visible has been that this is beyond counting. How the modern astronomer performs this apparently superhuman task is admirably set forth by F. W. Henkel.—The usual engineering notes, electrical notes, and science notes are also published.

Caveats Abolished.

Commissioner Moore's recommendation that that section of the patent statutes which provides for the filing of caveats be repealed, has been acted upon by Congress and the President. Henceforth there will be no more caveats in the United States.

Inventors ought to welcome this abolishment of a useless and inadequate legal provision. A caveat was never of much good. It was recorded evidence which served simply the purpose of securing notification to the inventor of the filing of an application for an invention similar to that disclosed in the caveat. An application for a patent does all that a caveat can do, and more.

Since we have discussed the bill adequately in a recent issue, it seems hardly necessary to dilate upon its sections here.

Official Meteorological Summary, New York, N. Y., June, 1910.

Atmospheric pressure: Highest, 30.26; lowest, 29.51; mean, 29.92. Temperature: Height, 91; date, 23; lowest, 48; date, 1st; mean of warmest day, 82; date, 23rd; coolest day, 54; date, 1st; mean of maximum for the month, 75.4; mean of minimum, 60.5; absolute mean, 68; normal, 68.5; average daily deficiency compared with the mean of 40 years, 0.5. Warmest mean temperature of June, 72, in 1888, 1892, 1899, 1906; coldest mean, 64, in 1881, 1903. Absolute maximum and minimum of June for 40 years, 97 and 45. Average daily excess since January 1st, 2.8. Precipitation: 5.10; greatest in 24 hours, 1.74; date, 11th and 12th; average for June for 40 years, 3.26. Accumulated excess since January 1st, 0.46. Greatest precipitation, 7.70, in 1887; least, 0.86, in 1894. Wind: Prevailing direction, west; total movement, 7,384 miles; average hourly velocity, 10.3; maximum velocity, 58 miles an hour. Weather: Clear days, 8; partly cloudy, 9; cloudy, 13; on which 0.01 or more of precipitation occurred, 13. Mean relative humidity at 8 A. M. and 8 P. M., 69.4. Dense fog, 16th. Hail, 18th. Thunderstorms, 17th, 18th, 21st., 27th.

Uncle Sam's New Way of Buying Coal.

The United States government buys about seven million dollars' worth of coal every year for use in the navy, in public buildings in Washington and other cities, and for other purposes, about one-third of it—mainly coal used in public buildings—on specifications under which prices are fixed according to the value or quality of the coal delivered by the successful bidder. A definite standard of quality for the coal thus purchased is specified by each bidder and this standard is considered in awarding the contract. If the value of the coal furnished is below the standard fixed, a discount is made from the contract price; if its value is above the standard an allowance is made for the excess of value and a proper sum is paid in addition to the contract price. The value is determined by tests and analyses made by the Geological Survey on samples taken from the coal furnished by the contractor. These analyses and tests show the quality of the coal in terms of fixed carbon, volatile matter, sulphur, ash, and moisture, and especially its heating value in British thermal units, as determined by calorimetric tests.

Until within a few years the agents of the government, in buying coal, relied upon the integrity of the dealer and the reputation of the mine or district from which the coal was obtained, and these formed the only possible assurance that the coal was equal in quality to the grade to be furnished. The new method has been so successful that it will probably be gradually extended to cover a larger share of the government's fuel supply.

A full statement of this method of buying coal is contained in a recent bulletin of the United States Geological Survey (Bulletin 428), entitled "The purchase of coal by the government under specifications, with analyses of coal delivered for the fiscal year 1908-9," by George S. Pope.

The bulletin includes a statement of the factors affecting the value of coal, a description of the methods adopted for sampling and testing, a form of specifications used under the new plan, a list of government contracts for coal for the fiscal year 1909-10, and a table of analyses of coal furnished for the fiscal year 1908-9.

The new plan has not yet been applied to fuel purchased for the vessels of the United States navy, but does cover about 400,000 tons of coal bought for use on the Isthmus of Panama and about 140,000 tons used on steamers plying from New York to Colon.

Correspondence.

EXPERT SUGGESTIONS AND COMMENTS ON THE RULES FOR THE GOULD-SCIENTIFIC AMERICAN MULTIPLE-MOTOR AEROPLANE PRIZE.

The announcement of the offer of a $15,000 prize by Mr. Gould for the best multiple-motor aeroplane has brought a flood of correspondence to this office, some of it solicited, the rest voluntary. With a view to ascertaining the views of leading men among those who have expert technical knowledge and experience in both the theory and art of aviation, the Editor asked for the written opinion of several of these. We publish herewith a few of the letters of reply. Others will appear in later issues of the SCIENTIFIC AMERICAN:

To the Editor of the SCIENTIFIC AMERICAN:

I have yours of the 14th, inclosing copy of rules governing the competition for the GOULD-SCIENTIFIC AMERICAN Trophy.

The rules as drawn up by you are excellent, and just at this moment I do not see that they need any additions.

However, I shall keep them constantly in mind, and if on further consideration of them I think of any suggestions I will communicate them to you promptly. CHARLES M. MANLY.

Whitehall Building, New York.

To the Editor of the SCIENTIFIC AMERICAN:

With reference to the inclosed preliminary draft of the proposed rules for the Gould $15,000 prize for the best twin-engine aeroplane, the only change which I would suggest is that the person making the entry should not be required to operate the machine.

It seems to me that this prize will offer an incentive to overcome what is now an inherent danger of the aeroplane, namely, the liability of the engine to stop or break, thereby causing the machine to fall.

A. LAWRENCE ROTCH, Director.

Blue Hill Meteorological Observatory, Hyde Park, Mass.

To the Editor of the SCIENTIFIC AMERICAN:

Your letter of June 14th was received during my absence, and was held for my attention. I think your tentative rules governing the Gould prize are first rate, and have nothing to suggest, unless that a clause be inserted that makes it understood that both propellers may be running all of the time. It would be very bad engineering to attempt to stop one propeller entirely. I think you can count on our entering a machine for the contest.

New York. G. H. CURTISS.

To the Editor of the SCIENTIFIC AMERICAN:

Referring to your article, "Mr. Edwin Gould offers $15,000," etc., which appeared in the issue of June 11th, 1910.

Explanatory of my main object will state: At this time I am gathering the material for the construction of a new type of heavier-than-air flying machine (for which application for a patent has been made) which will come within the scope of the statement given in the above-mentioned article. As the proposition enters upon new ground, and as you have kindly stated that "the Editor will gladly consider any suggestions which the reader may make," I offer the following:

Owing to the fact that some amount of experimenting must be done with flying machines as specified, considerable time should be allowed between the opening of the contest and the closing of the same.

It is possible that persons desiring to participate may be separated by great distance, therefore, the various trials should not be confined to any particular portion of the country, but allowed under similar rules at the point most available to the party or parties who shall enter their machines, if the same be satisfactory to the promoter.

The suggestions are offered with a view of gaining the most desired results by producing something new, furthering the improvements now under way, and allowing many more to produce that which they deem will advance the mechanical in aerial navigation, which would not be the case if contests were all confined to a limited district. HARRY H. HINDE,

Member Aero Club of California.

Riverside, Cal.

A CORRECTION.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of July 2d, on page 4, in the editorial entitled, "The Annual Slaughter of Trespassers on Railroads," the statement is made that "figures compiled by the Pennsylvania Railroad alone show that 465 *passengers* lost their lives on that system's lines in 1899," etc. This, of course, should have been trespassers, but it seems to me, in view of the seriousness of the mistake that a correction should be made. J. W. LEE, JR.

Philadelphia, Pa.

THE EARLIEST WRIGHT FLIGHTS.—A LETTER FROM WILBUR WRIGHT.

To the Editor of the SCIENTIFIC AMERICAN:

The SCIENTIFIC AMERICAN of June 25th contains an editorial which says: "Curtiss was using hinged wing tips in his earlier machines, with which he made public flights antedating the open flights of the Wrights." The use of the catch expression "open flights" is calculated to give to the general reader an entirely false impression regarding the real facts. The general construction of the Wright machines, and the method of control which has now become so widely copied, were well known to aviators in general and to Mr. Curtiss in particular long before he began building aeroplanes. The SCIENTIFIC AMERICAN of February 22nd, 1902, contains several pictures of Wright machines, and gives an abstract of an illustrated article in the printed Journal of the Western Society of Engineers, containing an account of the construction of the machine and its novel methods of control. In 1903 Mr. O. Chanute visited Europe in the interests of the St. Louis Exposition, and while in Paris gave an illustrated lecture on aviation in America, setting forth what he had witnessed during visits to the Wright camp at Kitty Hawk in 1901 and 1902. In the same year (1903) he wrote an article for L'Aerophile giving scale drawings of the Wright 1902 machine. Aroused by this news, several members of the Aero Club of France decided to form a sub-commission on aviation, the club having been heretofore solely a balloon society. Mr. Archdeacon, the prime mover, gave an order to a French workman for the construction of a copy of the Wright 1902 glider. This "aeroplane du type de Wright," from which grew the Voisin, Farman, and earlier Blériot machines, was tested at Berck in April, 1904, by a young man from Lyons, M. Voisin, it being his *début* in aviation. Pictures of this pioneer French-built machine of the "type Wright" were published in numerous French papers of that year and also in the New York Press of March 20th, 1904. A second Archdeacon machine with a motor was illustrated in the SCIENTIFIC AMERICAN of December 17th, 1904, which says in the accompanying text, "It resembles the Wright aeroplane in its general principles, but contains certain modifications in detail." The French patent, explaining in detail the new Wright system of control, was published in 1904. The American patent was published in 1906. The SCIENTIFIC AMERICAN of April 7th, 1906, published numerous pictures of Wright machines, and after mentioning the horizontal front rudder, says, "There may also be other patentable improvements for maintaining the transverse stability, such as a method of twisting the planes slightly at either end." In 1907 Dr. Bell organized the Aerial Experiment Association, with Lieut. Selfridge as secretary, and Mr. Curtiss as chief of construction. Lieut. Selfridge wrote to the brothers Wright in behalf of the association, asking for information regarding the construction of gliders, and was referred to the drawings and description in the Wright American patent and to the drawings and description in the Aerophile article of 1903. Lieut. Selfridge in answer said he had obtained a copy of the patent, and hoped to obtain the other paper soon. At first only the general form of the Wright machine was copied in the machines constructed by Mr. Curtiss, but soon the adjustable tips began to appear, their necessity having become apparent. It was only in 1908 that Mr. Curtiss began using adjustable tips. Judge Hazel was aware of these facts, and in his decision mentioned this correspondence as one of the reasons for granting the temporary injunction. WILBUR WRIGHT.

The 1910 Rheims Aviation Meet.

Last August the aviation meet at Rheims, which was the first aviation meet of any consequence to be held anywhere in the world, was a great success, and resulted in the making of many records, particularly that for endurance of 3¼ hours by Henry Farman in his biplane. In November, 1909, Farman increased this record to 144 miles in 4:06:25. This year the prinicpal records were made by monoplanes and were chiefly records of speed and distance. After doing some marvelous flying in wind and rain on the opening day of the meet (July 3rd), Charles Wachter was precipitated to earth from a height of 500 feet owing to the breaking of the wings of his Antoinette monoplane, and was instantly killed. This accident threw a pall over the opening days of the meet, but nevertheless some excellent flying was accomplished. On the third day, Alfred Leblanc covered 100 kilometers (62.1 miles) on his Bleriot monoplane in 1 hour, 16 minutes, and 11 seconds, or at the rate of 48.9 miles an hour. He also established new records for 30, 40, and 50 kilometers; while Morane, also on a Bleriot monoplane, beat Curtiss's 20-kilometer (12.4 mile) record of 15:50 3/5 by covering this distance in 13 minutes and 8 seconds. Mr. Curtiss, it will be remembered, won the Bennett cup race last year in the time above given, and thus brought the trophy to America. The Bennett race will be held this year on October 22nd over a 100 kilometer course above Long Island. Each nation is allowed three contestants. On July 5th, Latham, Leblanc, and Labouchere all qualified as the French representatives in the Bennett cup race for 1910. The first-named uses the Antoinette monoplane, while the other two avivators fly Blériot machines.

During the fourth day of the meet the weather was bad, the consequence being that very little flying took place. President Fallières visited the aerodrome, and Latham made a flight in his Antoinette monoplane despite the strong wind. Weymann and De Baeder, the latter carrying a passenger, also made exhibition flights on their biplanes for the President. All three exhibited great skill in battling with the wind.

On the fifth day, a new distance record was made by Olieslagers with his Blériot monoplane. The Belgian remained aloft 3 hours and 20 minutes and covered 256 kilometers (159.07 miles) at an average speed of 47.43 miles an hour. Farman's records for distance (232 kilometers or 144.4 miles) and speed were broken, although his endurance record was not touched. The other feature of this day was the height record established by Latham who, according to his registering barometer, attained a height of over 5,000 feet, although the height taken by the observers (who, however, were unable to see the monoplane during a considerable period when it was hidden by clouds) was 1,384 meters (4,540 feet). Latham made this spectacular flight as evening came on, and for fully fifteen mintes he was out of sight of the spectators. He came near losing his sense of the horizontal while soaring among the clouds. Hearing the bomb, which was exploded at 7 P. M. to announce the close of the meet for that day, he began his descent. Upon emerging from the clouds, he found himself above the city of Rheims. He then steered his machine back to the aerodrome in a long swift descent, and succeeded in landing beside the shed without mishap. Morane, on his Bleriot, also made a height record of 1,100 meters (3,600 feet). He ascended very rapidly and also made a swift descent. The sixth day of the meet new long-distance records were made by Olieslagers and Latham. After the latter had flown 150 kilometers (93.20 miles) in 2 hours, 1 minute, and 6 seconds at a speed of 46.18 miles an hour, the former twice beat this record by covering the same distance in 1 hour, 58 minutes, and 20 seconds and again in 1 hour, 54 minutes, 54 2/5 seconds. The latter time corresponds to a speed of 48.67 miles an hour. Olieslagers also reduced the 200-kilometer (124.27-mile) record to 2 hours, 35 minutes and 18 seconds, an average speed of 48.01 miles an hour. M. Leblanc made new records for five and ten kilometers of 3 minutes, 12 4/5 seconds and 6 minutes, 33 4/5 seconds respectively. These times correspond to speeds of 57.91 and 56.79 miles an hour.

The Asbury Park Aviation Meet.

Asbury Park's aviation meet was opened early last week with flights by Glenn Curtiss. Mr. Curtiss made trips up and down the beach, passing over the piers and performing evolutions above the sea. At one time, while running along the beach in order to start, a wave struck his propeller and smashed it. During several days, Curtiss made flights when considerable wind was blowing. Not till last Friday did Walter Brookins make his first flights at Atlantic City with his Wright biplane. Brookins drew exclamations of delight from the spectators at the dips and sharp turns he accomplished with his Wright machine. This is the first time that a Wright and a Curtiss biplane have flown in competition. The latter appears to be the faster machine, but it is intended to test out the speed capabilities of both in a 50-mile race before the meet is over.

The Chicago to New York $25,000 Prize Flight.

The rules were announced last week governing the aeroplane race from Chicago to New York to be held under the auspices of the Chicago Evening Post and the New York Times. The contest is to start on October 8th and is to be open only to aviators who have shown a record of sustained flight of one hour or more. Practice flights must be made in Chicago by all contestants during the week previous to the start of the race. All contestants must start upon the date set unless this is postponed because of adverse weather. The start may be delayed until October 15th. Seven days are allowed in which to complete the distance, which is approximately a thousand miles, if the line of the railroad is followed. Hamilton, Mars, and Captain Baldwin have already entered for this race, and it is probable that there will be at least a halfscore of entries.

FARMAN'S NEW MONOPLANE.

Farman has hitherto flown only with biplanes, either of the Voisin design or his own. Recently, however, he made his appearance with a monoplane of which we herewith present two photographs.

His new machine, so far as we can judge, seems very like his biplane, with the exception that the lower supporting surface has been removed. The span of its single surface is 25¾ feet, and the over all length somewhat less. The total weight is 660 pounds. The photographs show a novelty in construction, namely, that the main plane lies some distance above the framework, so that the aviator's view of the ground below is unimpeded.

The new machine is driven by a 50-horse-power Gnome motor and Chauvière propeller. The rudder is mounted above the rear plane with a triangular fin in front of it. The rear plane or tail is divided, the rear half serving as an elevator or horizontal rudder. Successful trial flights have been made by Mr. Farman in this new flyer.

The Synthesis of Caoutchouc.

As a result of the announcement by Prof. Harries of the synthesis of caoutchouc from isoprene, it has been rumored in Germany that the Elberfeld Farben Fabriken, the successors of Bayer & Co., in whose laboratories the same result had been obtained, had already commenced the manufacture of synthetic caoutchouc on a commercial scale. This is not true. At a general meeting of the stockholders of the company in April, 1910, the directors announced the successful synthesis of caoutchouc in the laboratories of the company, but admitted that the manufacture is not for the present commercially possible. On this occasion it was remarked that more than fifteen years elapsed between the first synthesis of indigo, which was effected by Prof. Bayer in 1880, and the beginning of the commercial manufacture of indigo by the Badische Anilin- und Sodafabrik in 1896.

The commercial synthesis of rubber will be immensely beneficial to the country in which it is first accomplished. The India-rubber industry is of comparatively recent growth, and first attained important proportions after the discovery of the process of vulcanization by Goodyear in 1839. Within the last half century the world's annual consumption of India rubber has been multiplied more than one hundredfold. It is now estimated at more than 70,000 tons, worth at normal prices about $130,000,000, and at the present inflated prices at more than $250,000,000. These figures show that the commercial synthesis of caoutchouc would be far more important than that of indigo, the annual consumption of which does not exceed in value $20,000,000. It should be borne in mind, however, that the current market price of India rubber has been greatly increased by the disproportion between supply and demand, and that the price of natural rubber would be greatly reduced by the accomplishment of commercial synthesis. This result has taken place in the case of indigo, and particularly in that of camphor. It is very likely also that the methods by which natural rubber is obtained can be greatly improved. Although the India rubber of commerce is derived from a number of species of trees, it is almost certain that the great differences between specimens coming from different countries are due chiefly to differences in the methods of collection and coagulation, some of which are very primitive. When the coagulation of the sap has been rationally studied and reduced to practice, it is almost certain that both the quantity and the quality of the product will be greatly improved, and that the inferior grades will disappear from the market.

A number of residences in suburbs of Chicago have recently been built of ordinary conduit tile. In the foundation four-way tile has been used with a 6-inch concrete wall on the outside. Above the foundation a 5-inch one-way tile was used with 3 inches to 4 inches of concrete on the outside. This outer coat of concrete was in some cases bush-hammered and in others scrubbed while green to expose the aggregate.

FRONT VIEW OF FARMAN'S MONOPLANE.

FARMAN'S MONOPLANE IN FLIGHT.

FLASHING THE HOUR FROM THE METROPOLITAN TOWER.

BY JOSEPH T. S. BAKER.

The illuminated clock in the tower of the Metropolitan Life Building, Madison Avenue and 23d Street, New York city, with its unique auxiliary feature, the flashing of time signals in brilliant incandescent electric lights, is one of the most interesting of the new things that may be seen nowadays in the metropolis. Remarkable enough, by day or when illuminated at night, is the great clock itself, at the twenty-sixth floor of the tower, with its four 26-foot 6-inch diameter dials, spanning three office floors, independently and synchronously driven from the master clock in the directors' room of the Metropolitan Life Insurance Company on the second floor of the main building. But added to this notable feat of clock-making and electrical engineering, and supplementing it, is the flashing of the hours—"visual chimes" in red and white light—visible from the country far around and fittingly replacing at nightfall the beautiful bell chimes that mark the time throughout the day. The whole constitutes a masterpiece of horology, a twentieth-century marvel made possible by electricity.

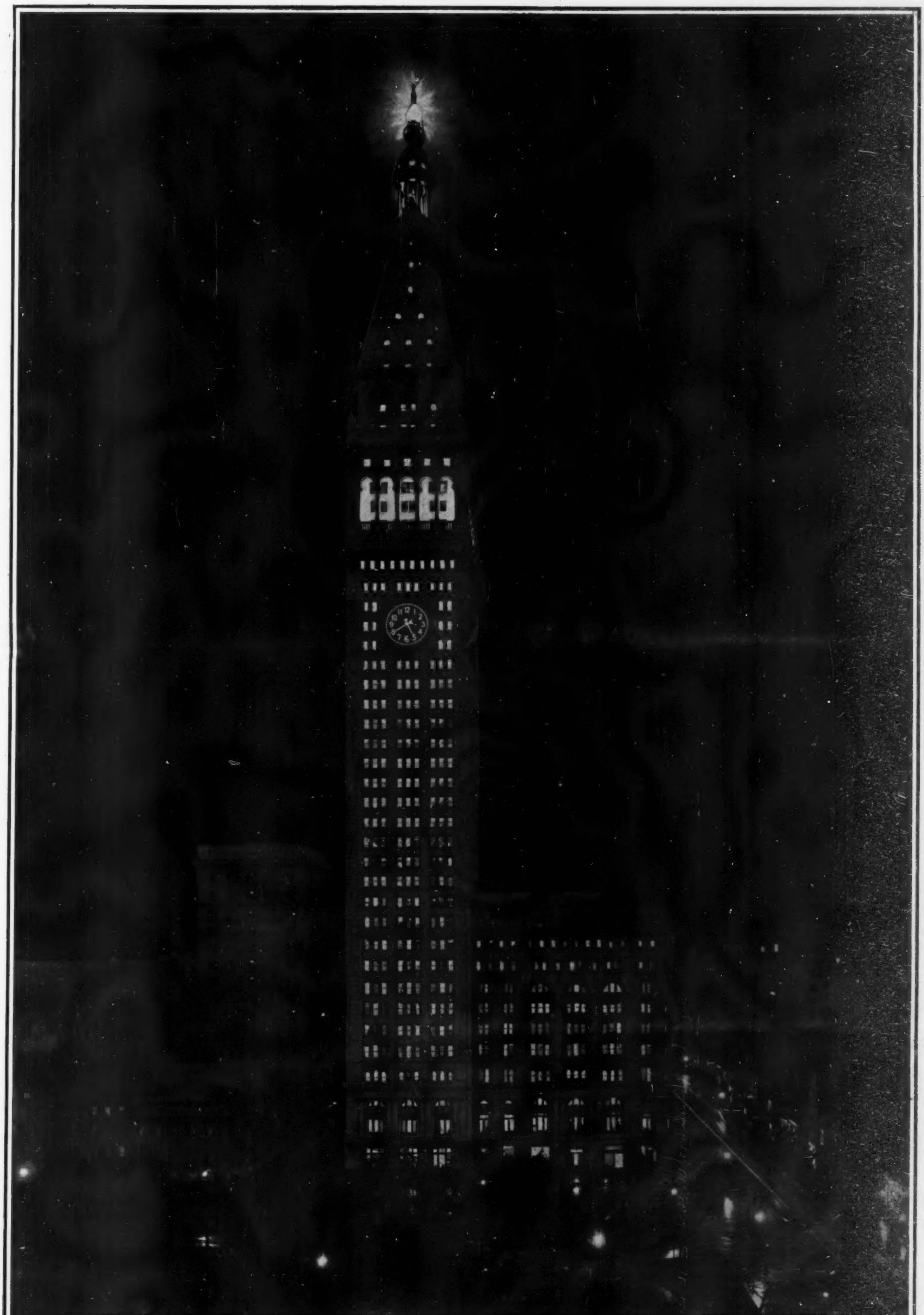
The master clock which is the soul or prime mover of the whole equipment is a handsome self-winding regulator, operating under a guarantee not to exceed an error of five seconds a month from true time. This clock is quipped with "transmitters," each independently self-winding, and electrically connected to relays and remote-controlled switches for operating the tower-clock hands, the chimes, and the flashers.

The lighting of the clock faces presents a marked departure from other "illuminated dial" tower clocks, in the way in which both the hands and the dial are limned in fire. The effect sought, and accomplished, is a brilliantly luminous pair of hands and circle of dial numerals, having far greater distinctness than has been attained in such work hitherto. By the special means employed all garish blurring, so common in much outdoor illumination, is avoided; the entire clock face appears sharp and clear, and the time may be read by it as far as it may be seen at all. To obtain this desirable effect, different means are employed for the hands from those employed for the dial.

The hands (minute hand seventeen feet long and hour hand thirteen feet four inches long) are of steel frame construction and copper incased, with fronts of wire glass. Each hand is lit up through its entire length, from within its structure, by a continuous row of "line-o-lite" incandescent lamps, there being sixteen of these lamps in the minute hand and ten in the hour hand. By the use of this type of lamp each clock hand appears at a little distance as a continuous line of light, not as a row of bright dots, as it would if made up of ordinary lamps. Thus, the hands look as "natural" at night as they do by day. There is an illuminated boss in the center of the minute hand, containing eight ordinary lamps. Ingenious means are employed to get at the lamps in the hands, for making renewals; the lamp sockets being mounted on hinged, folding carriers, so that they can be withdrawn through sliding doors in the copper sheathing of the hands near the inner ends of the latter. The electric-motor-operated driving mechanism of each dial is installed in the clock room back of the band arbors, on the twenty-sixth floor; the western dial clock room containing also the terminals of the special lighting feeders, the relays for operating the remote-control switches for flashing the hours and quarters, the switches themselves, and other appurtenances. From the clock rooms access is obtained to the hands, through shutters in the dial at the point where the arbors project through the same.

The illumination of the dial proper—the Arabic dial numerals and their inclosing circle of minute marks—is from concealed incandescent lamps contained in a large ferro-concrete casing projecting out some 30 inches from the wall of the tower and forming the back and support of the clock face. This casing is entered, for the purpose of renewing the lamps, cleaning the lamp reflectors, etc., by means of substantial steel ladders and platforms leading out of the clock room. The dial illumination is obtained by means not unlike showing the figures in a stencil by providing a well-lighted surface back of the stencil. In the Metropolitan clock faces, dial numerals 4 feet high and a 26-foot 6-inch circle of minute marks each 10½ inches in diameter are cut through the front wall of the casing, and glazed with heavy wire glass. Inside the casing and mounted on the back of the front wall are two hundred 20-candle-power tungsten incandescent lamps, in individual reflectors, so arranged in two concentric circular rows that all of the light is thrown against the white painted rear wall of the casing. Thus the glazed dial numerals, which show by day an effective contrast with the white surface in which they are cut, are illuminated at night by highly diffused light reflected from a large illuminated plane surface, and thereby show from outside the tower as brilliantly and evenly luminous numerals, cleanly defined and without glare.

The flashing of the time every quarter hour, from the lantern at the apex of the tower, is by red lamps for the quarters and white lamps for the hours. The flashing equipment is cut into action, at dusk every day, by a contact device which is operated from the mechanism of the tower clock hands, and which may be set to close the circuit of the flashing relays at progressively different hours of the evening with the advance of the season. When the clock lighting is "turned on," the heavy flashing switches, controlled by the master clock and its relays, rapidly close and open feeder circuits leading to a group of 56 red lamps and 88 white lamps, of 100 and 250 watts (giving an aggregate of 16,262 candle power), massed in a great torch flame at the highest reach of the tower, nearly 350 feet above the clock faces, or 700 feet from the street. For example, if the flashing service comes on at 4:50 o'clock on a midwinter afternoon, the hour of five will be announced, not only by the four quarters on the chime of bells, but also by four red flashes at the tower tip, for the quarters, followed by five white flashes for the hour. at 6 P. M. the chimes are cut out by a contact device similar to the device for cutting in the clock lighting. The white light burns steadily all through the hour except just before each quarter, at which time it goes out for a few seconds preparatory to the flashing.



FLASHING THE HOUR FROM THE METROPOLITAN TOWER.

MAGIC FOR AMATEURS—II

CARD, COIN, AND HANDKERCHIEF TRICKS

BY W. H. RADCLIFFE

NO. 3. THE MESMERIZED CARD.

Two packs of ordinary playing cards, preferably those having similar backs, and a thumb tack, are the articles necessary for the execution of the mesmerized card trick. Supposing the six of spades to be the active card in the trick, this card in one of the packs is placed at the top, face downward with the others. The thumb tack, Fig. 3, is pressed through the center of this card so that its point *n*, Fig. 4, projects through the back, and the head of the tack, indicated by the dotted lines, is held in place by the other cards below it. The pack thus prepared is placed on a table somewhat away from the audience and behind some other object upon it, so that it is screened from view.

Fig. 3.—THUMB TACK FOR CARD TRICK.

From the other pack a card is chosen by one of the spectators. In order that the card chosen be the same as used by the performer—the six of spades—it is desirable to resort to the following method of forcing it upon the chooser: The pack is previously arranged with the six of spades at the bottom, face downward with the other cards. Coming forward with his pack in the left hand, held at the sides between the tips of the thumb and four fingers, the performer raises his right hand and places his thumb beneath and his fingers on top of the pack as in Fig. 5. By means of his middle finger he slides back the cards at the top of the pack, one by one, for the distance of about an inch. Any one of the audience is given the privilege of signifying which one of the cards slid back he chooses, the performer informing the chooser he is at liberty to select any one he desires.

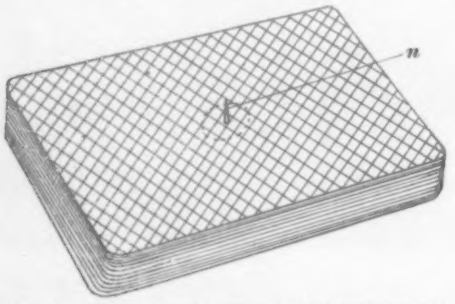


Fig. 4.—PACK OF CARDS, SHOWING THUMB TACK IN PLACE.

As soon as the chooser indicates his selection, the performer presses his right hand middle finger over the edge of the cards slid down and his thumb tightly against the bottom card in the pack, and thus slides them away from the others. By so doing, the card which was formerly at the bottom of the pack is brought up under those removed from the top (this movement is well hidden by the left hand) and when these cards are held up for the audience to see which card was selected, the chooser, as well as others in the audience, believes the card underneath to be the last one slid back and consequently the one selected. The performer, however, knowing the card underneath is the six of spades, need not look at it, but may, after all have seen it, hand it face downward with the others to some one of the spectators who is requested to shuffle and cut the pack. Returning with the cards to the table on which rests the pack fitted with the thumb tack, the performer lays down the shuffled cards behind the object which screens the prepared pack and then walks around the room to select, and if necessary to prepare, a flat surface such as that presented by a wooden door, against which he can throw the pack for the final result. Returning to the table the performer picks up the prepared pack, and the onlookers not having seen any cards except those from which the one was chosen, believe this pack to be the same that they previously shuffled.

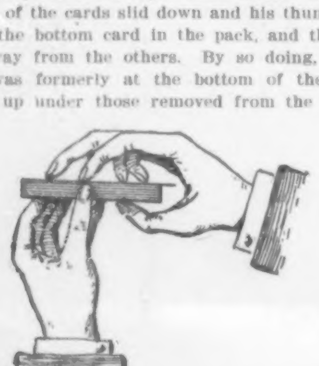


Fig. 5.—ONE OF THE BEST WAYS OF FORCING A CARD.

Standing a few feet away from the door the performer hurls the pack he holds, flatwise at the door; and if care has been taken to keep the cards well together, with the prepared card on that side of the pack nearer the door, the momentum of the pack will drive the thumb tack well into the wood, supporting thereto the six of spades. The other cards will, of course, drop to the floor. Pointing to the card on the door, the performer need merely bow and pass on to the next trick, for the card speaks for itself.

NO. 4. FORCING COIN THROUGH A TABLE.

The porosity of solid matter is usually a difficult subject to illustrate experimentally, but in this trick a coin apparently passes through a marble, iron or wooden table as easily as through water. Before performing the trick a dime is fastened by a small piece of beeswax to the underside of a table top at a point readily located by the performer from a glance at the top of the table. He commences the trick by passing a dime around for examination and calling attention to its date, which should be the same as on the dime fastened beneath the table, and places it in the part *b* of the device shown in Fig. 6.

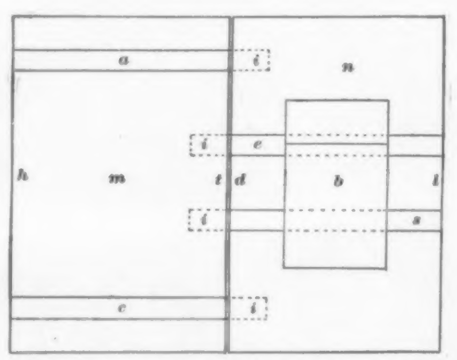


Fig. 6.—BOOKLET DEVICE FOR USE IN FORCING A DIME THROUGH TABLE.

This device consists of two pieces of cardboard *m* and *n*, each about two and one-half by four inches; these are hinged together by the one-quarter inch wide ribbons *ac* and *es* as shown, the dotted portions *i, i, i, i* representing the ends of the ribbons brought over and glued to the opposite side of the cardboards. The booklet thus formed can be opened at either side. The part *b* is of paper in two pieces, each piece about three and one-quarter by four and three-eighths inches in size, folded along the creases shown by the broken lines in Fig. 7. When folded, the two pieces are glued together, back to back, between the ribbons *e* and *s*, so that when one of the papers is visible the other cannot be seen.

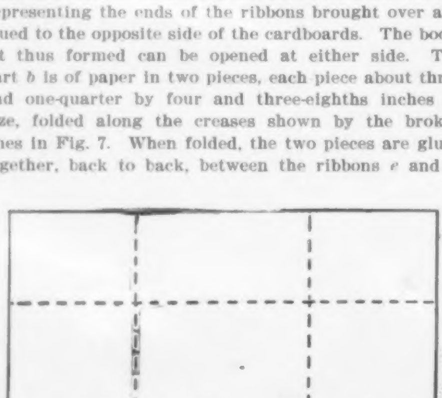


Fig. 7.—A DETAIL OF *b* IN Fig. 6. THE DOTTED LINES SHOW WHERE *b* IS FOLDED.

Either paper can be brought uppermost by opening the booklet at the proper side. This is due to the ribbons *e* and *s* on which the papers are mounted, shifting from side to side when the booklet is opened at alternate sides. Thus, when opened with the edges *h* and *l* outermost the four ribbons occupy the positions shown in Fig. 6, but when opened with the edges *t* and *d* outermost the ribbons *a* and *c* will shift to the side *n* and the ribbons *e* and *s* to the side *m*, thereby reversing the papers *b* so that the part which formerly was underneath is now on top.

The dime having been placed in one of the papers at *b*, Fig. 6, folded up, and the covers closed, the booklet is laid on the table as nearly as the performer can judge over the place where the dime is mounted beneath, and a handkerchief is thrown over the booklet.

Using his right hand, the performer pretends to press the coin through the booklet and table. With his left hand he holds a glass of water underneath the table top, pressing it upward and around the suspended dime so that when he is ready he can, by drawing the glass against the coin, cause it to loosen and drop into the glass of water. This he does when pretending to exert the greatest pressure upon the coin in the covered booklet.

Raising the glass from beneath the table, he shows the result of his pressure, taking care if the coin is to be taken out of the water and passed around for inspection to scrape off the wax that may adhere to its surface before handing it out. To prove conclusively that the coin has passed through the table, the performer opens the booklet (this time from the opposite side) and unfolding the paper within shows that the dime has actually vanished.

NO. 5. A HANDKERCHIEF LEVITATION.

Mr. Kellar, the well-known magician, often used this trick on the stage with slight modifications to mystify his audience. It should be performed in the evening in a not very brightly lighted room.

Previous to its presentation a black linen thread should be fastened at one side of the room to a tack, then led across the floor between the performer's stand and the audience, looped over a hook-screw on the opposite side of the room and passed down to one of the front chairs among the spectators' seats, to be later occupied by an assistant to the performer.

In Fig. 8, which shows a plan of the arrangement, *b* represents the performer, *s* the thread tied at one end of the tack *a*, looped over the hook-screw *c* and led to one of the watchers seated either at *x* or *v* who, beforehand, is taken into the confidence of the performer and instructed how to manipulate the thread. Up to a certain stage in the trick, the thread should be allowed to lie on the floor. The spectators should be directed to their seats so as not to pass over the thread. A small piece of wood or cork tied to the free end of the thread will aid the assistant in picking up the thread with the least noticeable effort. When ready to present the trick, the performer comes forward with a wand in his hand and requests some one in the audience to lend him a handkerchief. The wand should consist of a light wooden stick about twelve inches long and one-half inch in diameter. He returns with the wand and handkerchief to a position *b* just beyond the thread *s*, and then turning to face those present, sticks the wand under his left arm to hold it, takes the handkerchief by diagonally opposite corners and gives it a few twists so as to better tie it. The twisting of the handkerchief serves as a signal for the assistant to pull the thread taut, and if the nail and hook-screw have been placed at the proper height, the thread will be drawn to a level with the performer's hands when holding the handkerchief in a natural position in front of him. The performer now makes a knot in the handkerchief about one-eighth down its length and around the thread. By adjusting the folds of the handkerchief above and below the knot with the right hand, while the knot is held in the left hand, a very grotesque looking figure can be formed.

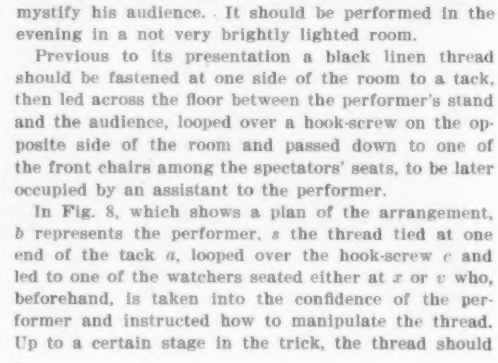


Fig. 8.—STAGE SETTING FOR BLACK ART PERFORMANCE AT HOME.

Still holding the figure in his left hand, the performer draws the wand from under his arm and gently lowers the figure to the floor, laying it flat thereon. He then proceeds to wave the wand over the handkerchief, when suddenly the latter appears endowed with life, rising to an upright posture and dancing to music or song. By waving the wand above and below the figure while it is in motion, the performer shows that there is no suspension. Finally, at the word of command, the handkerchief jumps high into the performer's hands, whereupon he unties the knot and tosses the handkerchief among the audience for inspection. In the meanwhile the thread may unobservedly be lifted off the hook-screw by the performer while he is at that side of the room and be drawn out of the way by the assistant.

(To be continued.)

PHOTOGRAPHING PROJECTILES IN FLIGHT

BY A GERMAN CORRESPONDENT

The possibility of utilizing photography to ascertain the ballistic peculiarities of moving projectiles was first pointed out in 1889 by the physicist, Friedrich Neesen of Berlin. He suggested the photographic investigation of conic pendulum action, velocity of flight, rotary speed, and also in the case of shot, grape-shot and shells, the scattering of the individual pieces. However, the method proposed by Neesen was imperfect, inasmuch as the photographic apparatus was to be carried by the projectile itself. It is true some pictures were secured in this manner, but no permanent success was achieved either by Neesen's investigations or by others conducted along similar lines by Krall, engineer in the Austrian navy.

Anschütz approached the problem of photographing projectiles in flight, from a different direction, but no result was obtained until the physicist Mack pointed to the use of the electric spark in securing snap-shot exposures. V. C. Boys in 1893 carried out the first reliable and practical method of photographic projectiles by the light of the electric spark.

In Germany Albert Preuss, an expert with the shotgun, was the first to introduce the photography of projectiles, for the purpose of studying the action of shot. In the neighborhood of Zorndorf, at the place where about 150 years ago Seidlitz's cuirassiers rested before the battle, Preuss founded in 1900 a scientific institute for the examination of arms and ammunition. The testing station, named Neumannswalde for Trade Councilor I. Neumann, Preuss's financial backer, is situated upon a small lake in a lonely locality, far from habitations and railways.

The experiments made at Neumannswalde for photographing shot are carried out in a dark cellar. An electric light plant enables white or ruby lamps to be switched on in this room. The installation is illustrated in Fig. 1. At the right we see a static electric machine, in the center two Leyden jars and at the left a peculiar combination of gun and photographic apparatus. By turning the crank at the right, electricity is produced which is collected in the two Leyden jars and then passes to the photographic apparatus through the two wires shown in the cut. The construction of this apparatus is of the utmost simplicity. The photographic plate is fastened upon a board in a vertical position. There is no plate-holder and no camera, but the photographic plate is suspended openly in the dark cellar which is lighted only dimly with a photographic dark-room lamp at the time of getting the apparatus ready. Opposite the plate is located the so-called spark-gap, that is, two points between which the spark is produced, their distance being adjustable. The electricity stored in the Leyden jars will not be able to jump the spark gap unless the two vertical sheet-metal strips shown at the extreme left touch each other. In the normal position, the strips are separated. When however a shot is fired from the gun clamped opposite them, the two strips are pressed together. At this moment a vivid light flashes in the dark space between the points of the spark gap and produces on the plate an image of everything which at that time lies between the spark gap and the photographic plate, that is to say, the major portion of the projectile positions which it is desired to photograph. In this dark cellar the first photographs of shot were made in Germany. The plates used for this purpose were often up to 28 inches long. A photograph of this character shows every individual grain of shot. Some grains of shot travel in advance of the main body and thus establish a contact between the two sheet-metal strips at a time when the main body is still in front of the plate. We can thus ascertain how various kinds and makes of cartridges behave as regards scattering. The most interesting phenomenon however is the strong air-wave, which precedes each of the individual grains. On account of its greater density, the air compressed in advance of the shot is pictured plainly on the photographic plate. Furthermore, if several grains of shot are photographed while close together, the plate will show clearly how the several air waves produced by different grains overlap in the image and are most opaque at the overlapping areas. Behind the entire charge the plate shows plainly a large number of small air-waves and eddies which break and flow into each other.

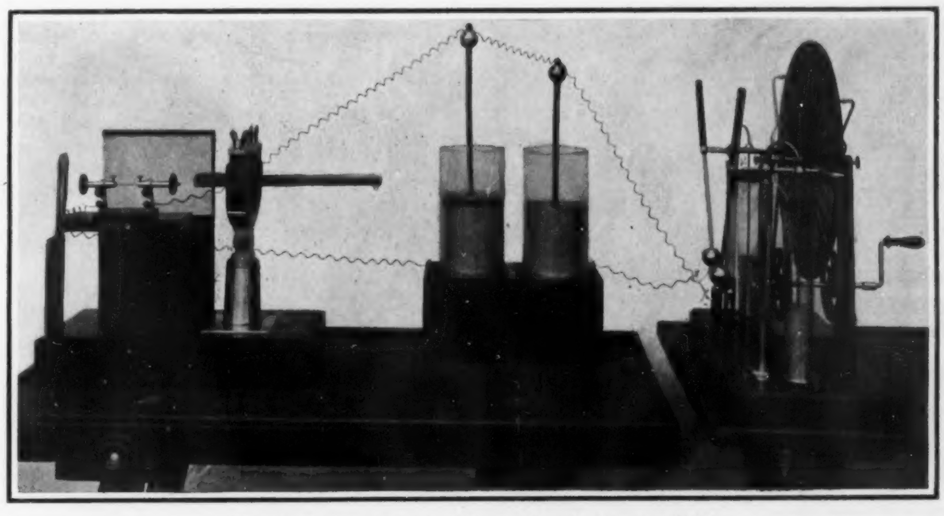


Fig. 1.—Apparatus for photographing bullets in flight.

In Fig. 2 the two contact strips appear clearly at the right, also the grains of shot and the air-waves. At the left we see the wad of the cartridge which follows the charge of shot at reduced speed. The few dark spots visible in the neighborhood of the wad are unconsumed powder grains. One of the shot grains has passed through the two contact strips, and has been noticeably flattened by the impact. In the rear of this grain fly some fragments of the contact strips, and it can be observed plainly how the air spurts out of the perforation made by the shot. In front of the grain of shot we see a large circle which represents the air-wave produced by the grain. The strong light in the rear of the contact strips is caused by the spark formed when they touch each other. If desired, the effect may be screened by interposing a piece of cardboard between the strips and the plate. It should be noted that everything shown in the illustration is due to the shot itself, that is to say, there was no background whatever during exposure. The electric machine must of course be placed in a separate room, in order that its spark may not disturb the perfect darkness of the room in which the exposure is to be made. In Fig. 1, at the left, we see a push-button for ringing an electric bell as a signal to the assistant that he should operate the electric machine.

Only photography can secure clear information as to the widening of the charge, the length of the space it will occupy, the scattering of the individual grains and their deformation. Some of the grains in Fig. 2 show plainly how far their originally spherical form has been altered by the pressure of the powder gases. A few of them seem to be almost cube-shaped. The beveling off of some grains causes them to deviate considerably from the line of sight, since they are deflected in the air by surfaces inclined to the trajectory. Up to the present it has been found impossible to photograph shot in flight at any considerable distance from the muzzle, and exposures are now generally made at distances of from 5 to 17 feet from the muzzle.

Materially different from the photography of shot in flight is that of flying bullets, which has been developed during the last few years by Privy Councilor Cranz at the military academy in Berlin. Mach's method is used and shows the bullet in flight together with the powerful air-waves, and eddies following the bullet. Privy Councilor Cranz has also secured exposures of automatic pistols and shots fired from them by a special cinematographic method. The time interval between two successive exposures is only about 1/5000 of a second, so that four hundred separate pictures are taken during the apparently minute interval between

(*Continued on page 58.*)

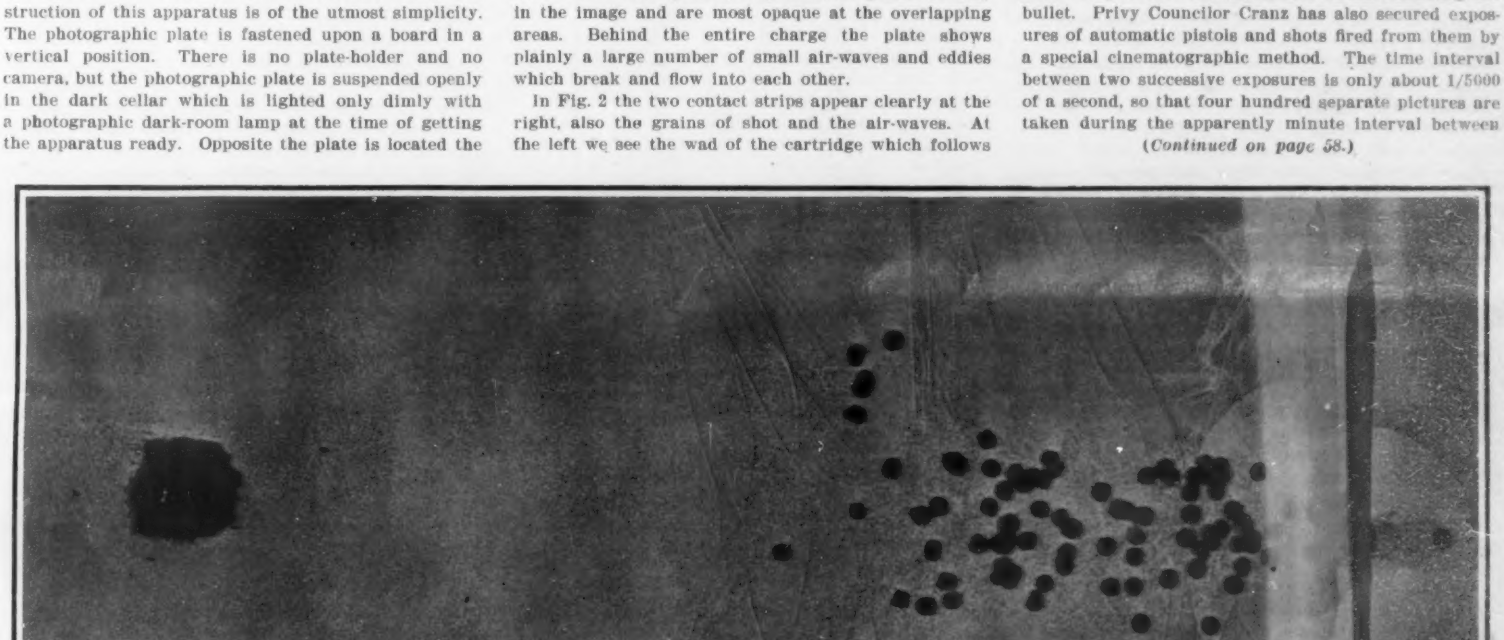


Fig. 2.—At the left is the wad of the cartridge which follows the charge of shot at reduced speed. One of the shot grains has passed through the target. It can be plainly observed how the air spurts out of the perforations made by the shot.

WHAT HAPPENS TO A BULLET FIRED FROM A GUN.

[The Editor of the Home Laboratory will be glad to receive any suggestions for this department and will pay for them, promptly, if available.]

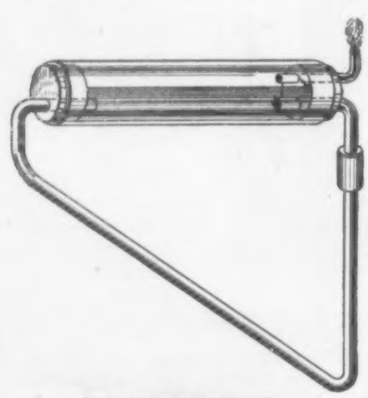
SIMPLE EXPERIMENTS IN STEAM AND COMBUSTION.

BY SIDNEY W. ASHE.

Experiments illustrating the operation of modern water-tube boilers, the reaction and the impulse steam turbines, etc., may readily be performed with the very simplest of apparatus. A Welsbach glass chimney, two discarded round quart cans, such as are used for gasoline, a few pieces of cardboard and glass tubing, a darning needle, a piece of No. 12 copper wire, a few corks, a piece of flexible metal pipe, and the kitchen stove form the necessary laboratory equipment.

EXPERIMENT 1. THE WATER-TUBE BOILER.

Take the Welsbach glass chimney and into each end fit a tight-fitting cork. If regular corks are not

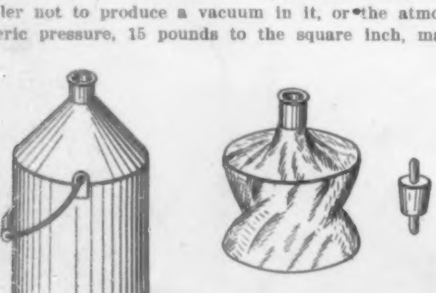


WATER-TUBE BOILER.

available, they may be cut from the cork covers used on discarded pickle and jam jars. The corks should be covered with paraffine to insure a tight fit, care being taken not to break the fragile glass chimney. A piece of pipe ½ inch in diameter, preferably lead, such as may be stripped off an electric light cable, should then be bent as in the illustration. In order to have access to the chimney, a small piece of glass tubing bent at right angles, with a small piece of hose coupling or a cork connector, may be used. Fill the glass chimney with hot water so that it is almost half full, covering the inlet and outlet pipes. Insert the cork and support the apparatus in a horizontal position, as in the figure, over a fire, heating the inclined tube near its short upright connection. After a time the circulation of the water will become apparent; the steam mixed with water in the tubes rising in the headers and discharging into the steam drum. The cooler water being heavier, by gravity, will be noticed to pass across the steam drum, where it will enter the header to the right and circulate down to the heated tubes. The steam should be allowed to escape by means of a small glass tube from the steam drum to atmosphere. Water is a very poor conductor of heat.

EXPERIMENT 2. VACUUM EFFECT IN A STEAM BOILER.

Care must be taken in the operation of a steam boiler not to produce a vacuum in it, or the atmospheric pressure, 15 pounds to the square inch, may

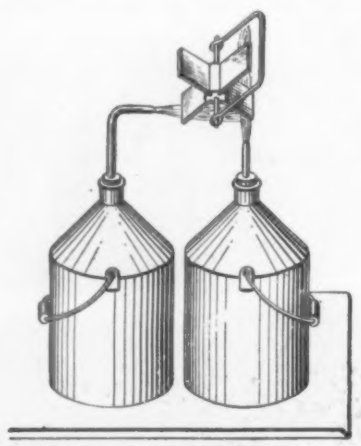


VACUUM EFFECT IN A BOILER.

cause the boiler to collapse. This point may be illustrated by the following striking experiment: Take a discarded gasoline can, as in the illustration, and fill it to the depth of ¼ inch with water. Have handy a tight-fitting cork stopper, which may then be placed securely in the opening in the can. This stopper should have a small hole passed through it, into which at the critical moment may be forced a piece of glass tubing, both ends of which have been sealed and rounded in a gas flame. With the cork stopper in the can, and also the water, place the can upon the stove and allow the water to come to a boil, so that steam is passing out rather rapidly through the hole in the cork, and so that the can has become almost too hot to handle. When this condition has occurred, force the glass tubing into the hole in the stopper, completely sealing it. Quickly remove the can from the fire, and turning the can upside down plunge it in a receptacle of cold water so that it is completely covered. The can should be held submerged, when after an interval of about 15 seconds the steam in the can will condense and the can will collapse.

EXPERIMENT 3. IMPULSE STEAM TURBINE.

The principle of the impulse type of steam turbine is somewhat similar to that of a pinwheel. To

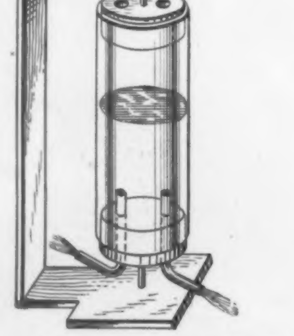


IMPULSE TURBINE.

show the principle of a two-nozzle type of impulse turbine, arrange two tin cans like those used in the previous experiment, with tight-fitting corks through which pass two glass tubes extending about one inch below the cork. The glass tubes should be drawn out at their tips, so as to form a contracted orifice. One of the tubes should possess a right-angle bend. The turbine rotating element is made by passing a darning needle through a large cork and slitting the cork to a depth of ¼ inch, producing four cuts, into which should be inserted four pieces of cardboard at 90 deg. to each other. A piece of No. 12 wire is next bent so that it has two hooks, which will support the rotating element, and so that it may be held in the hand. It is well to have two pieces of cord passed around the corks in the cans and tied to the handle of the can, so that if the steam pressure should become sufficient to blow the stopper out of the can, no damage will be done. Place a small amount of water in each can—to a depth of ½ an inch—and place the cans upon the kitchen stove. One of the glass nozzles should be longer than the other, so that their steam gets well across at their point of greatest energy. By adjusting the turbine element properly with the hand, the speed of the element and its direction of rotation may be varied. The speed of the impulse type of turbine is very high.

EXPERIMENT 4. REACTION WATER TURBINE.

Take a Welsbach glass chimney and mount a cork

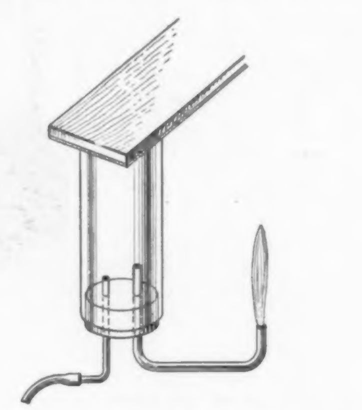


REACTION WATER TURBINE.

stopper in each end of it, taking care not to break the chimney. Into each stopper mount part of a darning needle, taking care to have the needle central and plumb. In the upper stopper two fairly large holes should be made, so that water will pass readily into the central receiver. In the lower stopper two glass tubes should be fitted, so that they will discharge water into a plane parallel to a base support and in the opposite direction to that in which it is desired that the turbine element should rotate. A wooden support should be arranged as in the illustration, to hold the turbine element, and weighted so that it will remain upright. A rubber tube should be arranged to connect with some reservoir of water, such as a pail mounted on a chair above the turbine element or connected to the house faucet. Place both fingers over the outlet tubes, allowing the water to fill the tube. Remove fingers, and allow element to rotate. The speed with which the turbine will rotate depends upon the head of water in the tube. The principle of this experiment is similar for both the steam turbine and the water turbine, rotation being caused by the reaction of the gas as it leaves the nozzles. Be sure that element can rotate freely.

EXPERIMENT 5. INVERT FLAME OF AIR IN GAS.

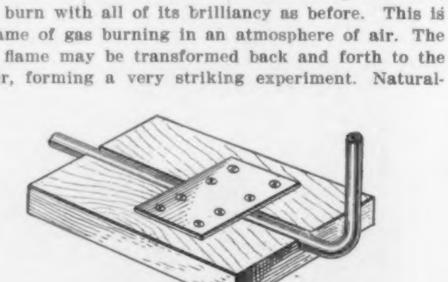
When a current of air passes up through the grate of a furnace, causing the coal to burn, carbon dioxide is formed, which is split up in the heated furnace into carbon monoxide and free oxygen. The carbon monoxide, known as coal gas, is sometimes seen as a bluish flame playing over the top of the fire. When the carbon monoxide burns, it forms carbon dioxide again, burning with a yellow flame. If the supply of air is too small, an excess of carbon dioxide is found in the firebox. The effect of carbon monoxide and carbon dioxide burning may be illustrated by the follow-



INVERT FLAME OF AIR IN GAS.

ing interesting experiment, which also brings out the fact that it is not only possible to burn a column of gas in an atmosphere of air, but that it is also possible to burn a column of air in an atmosphere of gas.

In the bottom of a Welsbach glass chimney is fitted a stopper in which are inserted two glass tubes. One of these should be about ¼ inch in diameter, and should be connected by means of a rubber hose to a gas supply. The other tube should be about ½ inch in diameter, and should have two right-angle bends in it, the distance between bends being about 5 inches. Over the top of the Welsbach chimney should be placed a rectangular piece of wood covered with a small piece of carpet, the wood resting lightly upon the glass with the carpet side down. Turn on the gas supply, and when the gas is issuing from the free end of the larger tube, light the gas. The flame should be regulated by regulating the gas supply to the smaller tube until it is about 8 inches high. Then raise on one side the wooden cover slightly, and the flame will reduce to a small head at the end of the larger tube. It will then travel along the glass tube, and burn with a faint bluish flame inside of the Welsbach chimney. This is a jet of air burning in an atmosphere of gas. Placing the raised edge of the wooden cover firmly upon the chimney, the head of flame will travel back along the tube, and burn with all of its brilliancy as before. This is a flame of gas burning in an atmosphere of air. The one flame may be transformed back and forth to the other, forming a very striking experiment. Naturally, the whole apparatus should be supported in a vertical position, and this may be done in two ways—either by passing a clamp around the Welsbach chimney or by cutting a groove in a piece of wood and resting the larger tube in it, fastening the tube in place by means of a strip of tin. This latter method is a good one if an ordinary clip stand

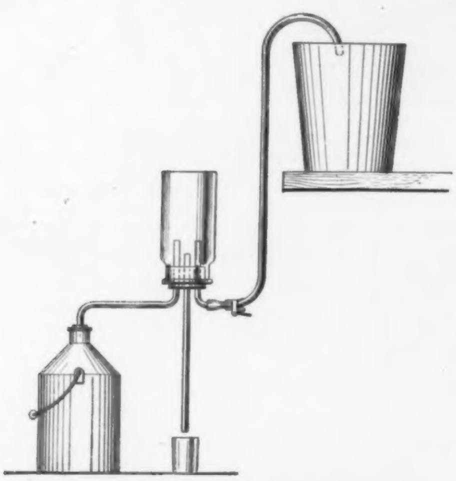


SUPPORT FOR TUBE.

is not handy. Care must be taken in building this apparatus not to have the bends of the larger tube too abrupt. They should possess a round, smooth curve, otherwise the bead of flame as it passes to and fro will be extinguished. Also, the flame should not be allowed to burn too long, or the tubes will crack. After a few trials the experiment may be easily performed—the main trick with the experiment comes with manipulating the piece of wood properly, which rests on top of the Welsbach chimney.

EXPERIMENT 6. JET CONDENSER.

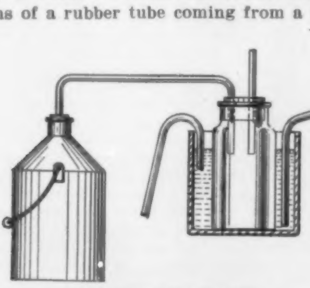
To illustrate the principle of the jet condenser, recourse may be made to the steam generator used in the previous experiments, which should be connected by means of a glass tube to an inverted glass jar. The stopper of this jar should be arranged with three holes to accommodate three glass tubes. One tube previously mentioned extends to the steam generator; another tube, whose outlet is lower than the others, extends to a glass receiver below it; the third glass tube is connected to a flexible hose coupling, which terminates in a supported pail of water. The inverted jar or the condenser should be supported, the character of the support depending upon the manner in which the steam generator is heated. The flexible hose connection coming from the main reservoir should be provided with a small clamp, so that the flow of water may be controlled at will. Place the steam generator upon the stove, having it partially filled with boiling water, and allow it to generate steam. After a time steam will pass into the condenser, which will become coated with mist, the steam passing out from the lower outlet into the top of the collecting glass. When a steady flow of steam is taking place, open the clamp and allow the cold water to enter from the main reservoir. If the glass outlet for this water is partially drawn and is contracted, the water will discharge in a fountain into the condenser. Instantly the steam will become condensed, the mist disappearing, the mixture of steam and water leaving by the drip tube.



PRINCIPLE OF THE JET CONDENSER.

EXPERIMENT 7. PRINCIPLE OF THE SURFACE CONDENSER.

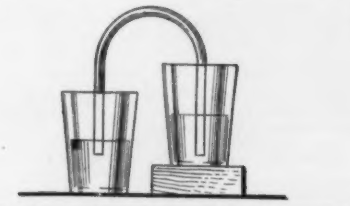
Use the steam generator as applied to the previous experiment, except that the condenser is placed in an upright position as in the illustration, the steam passing into it and escaping from the vent tube. Allow cold water to circulate about the condenser, entering a receiver which surrounds the condenser by means of a rubber tube coming from a main reservoir, leaving the receiver by means of another tube, which siphons it off to a pail. In practice the surface condenser consists of a number of tubes into which steam is passed, salt water being circulated around the tubes by means of rotary centrifugal pumps. In the bottom of the condenser is a receptacle termed the hot well, from which the condensed water is pumped by a small high-speed turbine pump to the heaters. The advantage of the turbine pump is that it will pump hot water. As considerable air comes over from the boiler with the steam, it is necessary to extract this air in order to maintain the vacuum in the condenser. This is accomplished by means of the dry vacuum pump connected to the condenser. Each condenser is then provided with three pumps—the vacuum pump, the hot-well pump, and the circulating pump. In some of the large companies, notably the Boston Edison Company, all of these pumps in addition to the feed-water pump are arranged around the turbine, so that they can be readily inspected by the engineer in charge. The amount of salt water which is pumped through the condensers in a day is enormous. With the Gold Street plant of the Brooklyn Edison Company, it is greater than that used in the city water mains.



SURFACE CONDENSER.

EXPERIMENT 8. THE NATURAL CIRCULATION OF WATER.

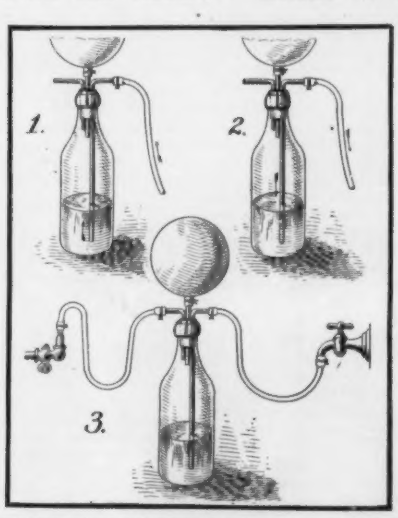
The design of modern systems of piping in large power houses depends to a great extent upon the natural circulation of water under atmospheric pressure. This principle may be shown in an attractive way by the following simple experiment: Take two ordinary glass tumblers, and have a block which will raise one of the tumblers about two inches. Fill both tumblers half full of water, and into one tumbler place about five drops of ammonia, and in the other tumbler place five drops of a solution of phenol-phthalein. Ten cents worth of phenol-phthalein dissolved in alcohol may be purchased in any drug store, and when this solution comes into contact with an alkaline solution such as ammonia, it turns the liquid red. Bend a glass tube U shaped, and fill the tube with water. Then placing the fingers over both ends of the tube, invert it so that each end will be submerged below the water in each tumbler. Then raise one of the tumblers on a block, the one containing the phenol-phthalein solution. The liquid in this glass will begin immediately to fall, the liquid in the bottom of the other glass turning red. When the liquids become level, insert the block under the other glass, removing it from its former position. The liquid will now return to the other glass, turning white again. This liquid phenol-phthalein may be used in a great many experiments to show electrolytic dissociation, circulation of water, the affinity of ammonia gas for water, and tests for alkalies.



CIRCULATION UNDER ATMOSPHERIC PRESSURE.

INFLATION OF RUBBER BALLS.

Rubber balls, large or small, protected by an envelope of leather, gradually contract and thus lose all their elasticity, and from this moment are out of use unless one possesses the means of reinflating them. It is then necessary to carefully loosen the rubber that compresses their tubulure, to introduce air under pressure into them, and to reclose them. The pressure that can be exerted with the lungs is far from sufficient, and, for want of a force pump, it is necessary to seek for an arrangement capable of replacing that apparatus. We shall describe here a small installation that serves for this purpose.



TWO METHODS OF INFLATING A SMALL RUBBER BALLOON.

A bottle is provided with a wired cork containing three apertures, designed to receive as many glass tubes. One of the latter extends to the bottom of the bottle, the second is provisionally corked, and the third is drawn out to a point and smoothed with a lamp so as to present no sharp angle. The first is connected to a faucet, and to the third is firmly attached the ball to be reinflated. After this, the water is allowed to flow into the bottle, and this forces air under pressure into the ball. Then, when the ball is judged to be sufficiently inflated, the faucet is closed; but, if the entire contents of the bottle are insufficient, the faucet is closed a little before the latter is full of water. A provisional ligature is applied to the ball, then the rubber is detached from the conduit and the contents of the bottle are allowed to flow out after opening the tube No. 2.

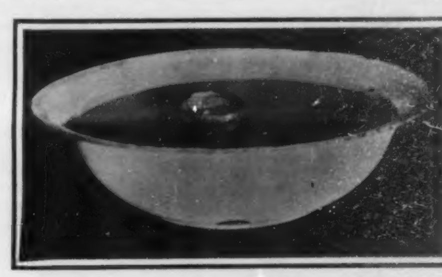
The first operation is begun again, care being taken not to reopen the ball until a little water has been allowed to enter the bottle. If there is a cock at one's disposal, it should be placed between the tube, No. 3, and the ball, and the latter need not then be reattached before the end of the operation.

In order to introduce illuminating gas into rubber balloons, it will suffice to lead it to tube, No. 2. The bottle being first full of water, and the balloon empty of air, the water is siphoned out, allowing the gas to enter, then the gas-cock is closed, and the gas may be forced in by allowing the water to re-enter. This operation seems to be complicated, but in reality it takes less time to perform it than to describe it. Fig. 1 shows the arrangement of the apparatus for the compression of the air. In Fig. 2 the bottle is being emptied in order to give what may be called a second piston stroke. Fig. 3 gives a view of the installation as a whole for inflating a balloon with illuminating gas.

A HYDROSTATIC PARADOX

BY PROF. GUSTAVE MICHAUD, COSTA RICA STATE COLLEGE.

A curious experiment can be performed with a common wire tea strainer. The fork is removed, and you place the little hemisphere of wire on the surface of water. It is full of wide-open holes; everybody in the company can see them; yet it remains on the surface, and not a drop of water gets in. You take it, drop five cents into it, and place it back on the surface of water. Here it remains again, although displacing perceptibly more water than before. A second, a third, nickel may be added. The strainer goes each time somewhat deeper into the water, but, in spite of the increased hydrostatic pressure, water seems unable to pass through the numberless square holes, and the inside of the strainer remains perfectly dry.



THE STRAINER FLOATS DESPITE ITS PERFORATED BOTTOM.

Now comes the most interesting part of the experiment. You remove the whole freight carried by the little craft, open a small box, take from it a light, tiny piece of cotton, and drop it into the floating strainer. At the very moment when the cotton touches the wire, the strainer goes instantaneously to the bottom, almost as if it were solid lead, the cotton remaining, of course, on the surface. Things look very much as if a flock of cotton, the weight of which cannot be felt in the hand, outbalanced the weight of a much larger mass of metal.

The explanation of the paradox lies in the intervention of a force which may be made to act with or against gravity. Before the experiment, the strainer has been covered with a thin layer of a greasy matter which water does not wet. In such circumstances, surface tension causes the water to be strongly depressed by the wires and to exert upon them an upward pressure which, added to hydrostatic pressure, balances the effect of gravity. The flock of cotton has been previously moistened with alcohol, and still carries some of that liquid. This almost imperceptible amount of another fluid instantaneously modifies the surface tension, and so weakens its upward pressure that the equilibrium cannot subsist.

A drop of carbon disulphide or of turpentine oil produces the same effect as alcohol, but, if cotton is used, alcohol is the only one of the three liquids which gives satisfactory results.

To prepare the strainer for the experiment, melt a candle in a tin can placed over the kitchen stove. Dip the clean and perfectly dry strainer into the liquid. Leave it there for a few seconds. Take it off and shake it immediately, so as to remove the molten stearin from all or nearly all the holes. Then lay the strainer with its convex surface upward until it is cold.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

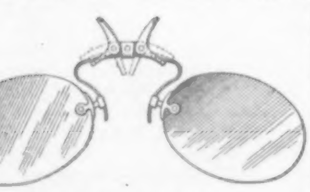
HEAD-FORMING DEVICE.—S. ROMAN, New York, N. Y. The object in this invention is to provide a device for properly shaping fur heads, which can be easily and quickly manipulated by means of which the fur heads can be given the desired shape, which permits the head to dry rapidly while being shaped in the device, and which can be inexpensively manufactured.

Electrical Devices.

STORAGE BATTERY.—C. F. WASHBURN, New London, Conn. The more particular purpose in this case is to lessen the weight of storage batteries by providing plates made of such materials and having such form as to provide a maximum of efficiency coupled with a minimum of weight. The weight of the battery as a whole is materially reduced by the use of the negative pole electrode made largely or completely of aluminium.

Of General Interest.

EYEGLASSES.—C. ALTER, 500 East 83rd Street, New York, N. Y. The object of the invention is to provide improvements in eyeglasses, whereby the same can be readily



EYEGLASSES WITH IMPROVED BOW.

placed in position on the nose or removed by manipulating the bow spring, to move the lenses a sufficient distance apart to allow of conveniently placing the glasses in position on the nose or removing them therefrom.

LOOSE-LEAF BINDER.—W. C. TRAHER, London, Ontario, Canada. The aim here is to provide a binder which can be inexpensively manufactured, which comprises few parts, which can be easily attached and detached from covers of different kinds by an unskilled person, and by means of which the leaves can be securely held against displacement through permitting them to be turned easily.

ATTACHMENT FOR CAMERAS.—C. W. KAUFMANN, New York, N. Y. This invention consists of a base member having means substantially centrally arranged for detachably applying it to the tripod, and a sliding member carried on the base member and having means for securing flat to its upper face the base of any ordinary form of camera, and means to lock the sliding member centrally over the tripod and at equal distances to each side of a central position.

Hardware and Tools.

SAW-HANDLE.—W. S. LOCKE, Lents, Ore. This patent consists of a simple and conveniently operated device for connecting saw handles detachably to the blades. A stirrup is supported from the shank of the handle and the handle can be manipulated in applying the stirrup to and removing it from the saw blade, the stirrup forming when applied to the blade a separate bearing section detachable therefrom, and adapted for engagement by the shank of a handle.

HEATER FOR EVAPORATORS.—G. H. GRIMM, Rutland, Vt. This invention permits the initial heating of sap or other liquid to be treated prior to its passage into the boiling pan, the heater being removably set in the pan, and the inlet and outlet for the liquid are arranged for convenient right or left hand connection with the overhead storage tank and the regulator, and the heater provides a large heating surface and is provided with means for escape of air and excess vapors rising from the heated surface liquid.

HEATER.—C. C. SCHAEFER, Cambridge City, Ind. The object here is to produce a heater adapted to burn gas, having a construction presenting a screen or shield which is disposed about the flame, and further to provide means for increasing the radiating surface. The construction will insure a thorough circulation of air through and across the heater surface.

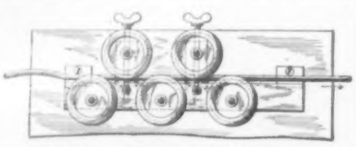
Household Utilities.

INSECT-DESTROYER.—T. R. WALLIS, Dyersburg, Tenn. This destroyer is provided with a cushion of wire cloth, a stick and means for securing cushion and stick together, the cushion consisting of two layers of the cloth united at their edges, the stick having one end extending between the layers to hold it apart up to the united edges, whereby the implement is rendered durable and flexible to prevent damage to a fall furniture, curtains, etc., when using the implement.

Machines and Mechanical Devices.

CIGAR-VENDING MACHINE.—W. D. EVANS and J. T. MARSHALL, Eupora, Miss. This invention provides a machine wherein a single vending mechanism will be used to operate upon a plurality of this or cigar containing boxes; provides a mechanism for selecting one of a number of brands of cigars and to have the same delivered by the machine, and provides against tampering with the mechanism.

STRAIGHTENING MACHINE.—J. P. HAGA, 1019 East 28th street, Minneapolis, Minn. The machine is employed for easily and ex-



WIRE STRAIGHTENING MACHINE.

peditiously removing bends or other malformations from fence wire or other elongated bodies. It can be easily put up and taken down, it permits of adjustments to adapt it for use with various kinds of wire or the like; it is compact in form, and it can be inexpensively manufactured.

COPY-HOLDER.—S. STEINMEYER, Bonaparte, Iowa. This improvement is adapted for use alone or with a typewriter, and in the former case the brackets are removed by withdrawing the edges from the openings in the edge of the base. When used with the typewriter the brackets are engaged with the machine, the holder being supported thereabove. The base is provided with rubber covered feet, upon which it rests when used alone.

Prime Movers and Their Accessories.

LIQUID-COOLING DEVICE.—D. H. MOORE, Greenville, Mich. The purpose of this inventor is to provide a device for gasoline engines which may be cheaply constructed while efficient for the purpose, and which will dispense with the greater possible amount of piping, and wherein both the fluid to be cooled and the cooling fluid will meet under the most favorable conditions.

PACKING-RING.—C. E. DROWN, Tucson, Ariz. The invention refers more particularly to rings such as are resilient in construction and serve to keep the packing of pistons or the like firmly in position. The device is provided with an outwardly disposed flange, the latter engaging the packing to prevent it from becoming displaced or from losing its shape.

ROTARY ENGINE.—R. C. LEEDHAM, Trinidad, Colo. In this case the invention pertains to improvements in rotary engines of that type in which the rotor carries an outwardly-extending piston movable through an annular chamber, and in which the flow back of motive fluid is cut off by a rotary abutment recessed to permit the passage of the piston.

Railways and Their Accessories.

CAR-FENDER.—W. T. WATSON, Vancouver, British Columbia, Canada. The main object of this invention is to so construct the fender that it will remain in a rigid position and out of engagement with the track until said fender comes in contact with an obstruction, at which time the fender will be released and automatically dropped to pick up the obstacle, be it a fallen person, animal, or other body.

METALLIC RAILROAD-TIE.—S. T. WILSON and C. K. MCDERMOTT, Charleston, W. Va. The aim of the invention is to provide a tie which will hold the rails to the proper gage regardless of their size, and wherein a special cushioning device is provided for the rail. The tie is cushioned to a considerable extent by a block, thus increasing the life of the rail, and also lessening the wear of the rolling stock.

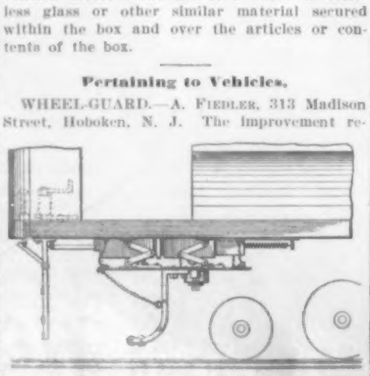
RAIL-JOINT.—J. W. ENRIGHT and E. J. ENRIGHT, New Orleans, La. The object here is to prevent longitudinal displacement or "creeping" of the fish plates, which will do away with the necessity for tapering the socket plate or seat. The construction enables the joint to be readily bonded, as may be desired in electric railways, and provides means for preventing the accidental withdrawal of the wedge plates.

Pertaining to Recreation.

TRICK-BOX.—A. JEBEL, New York, N. Y.—This invention relates to improvements in trick or joke apparatus, the object of the inventor being to cover or secure articles within a box in such a manner that the retaining means will normally be invisible. The invention involves the use of a sheet of colorless glass or other similar material secured within the box and over the articles or contents of the box.

Pertaining to Vehicles.

WHEEL-GUARD.—A. FIEDLER, 313 Madison Street, Hoboken, N. J. The improvement refers to guards for use in connection with street cars and other vehicles, and has reference more particularly to a device in which is provided a fender movable bodily in a substantially vertical direction, and adapted to be controlled by a gate under the car, or by a device operable by a person on the car.



WHEEL GUARD FOR STREET CARS.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of June 18th, 1910, or will be sent by mail on request.

(12260) F. K. asks: On page 79 of "Ammonia Refrigeration," by Redwood, he says, when the ammonia gas enters the compressor cylinder, the gas is so rarefied by coming in contact with the hot cylinder walls as to weigh upward of 30 per cent less than it would if the gas had remained at the same temperature as in the suction pipe, therefore we must subtract 30 per cent of the compressor piston displacement in obtaining the weight of ammonia circulated. Yet on page 90 he explains that the back pressure line should show (on an indicator diagram) the same pressure as that indicated by a pressure gage in the suction pipe, if the suction valves are properly proportioned to the speed of the piston. Now I do not exactly understand why we should subtract this 30 per cent, if the gage shows, say, 10 pounds, and back pressure line on the indicator card also shows 10 pounds in the cylinder; for would not a cubic foot of gas at 10 pounds pressure in the hot cylinder weigh as much as a cubic foot at 10 pounds pressure in the suction pipe? A. The reason for subtracting 30 per cent of the piston displacement to obtain the volume on which the weight of the suction gas received by the refrigerating compressor is computed, is that the gas entering the cylinder is heated by contact with the hot metal, and expanded *at the same pressure* so as to occupy more room for the same weight, or what is the same thing, to weigh less for the same volume. A cubic foot of gas coming through your suction pipe is cold and comparatively dense or heavy. When it passes into the cylinder, it is heated by contact with the walls. If the cylinder has one cubic foot displacement, not all the cubic foot of cold gas can get into the cylinder at one time, for the first of the gas passing through the suction valve expands in the hot cylinder so as to keep back the last of the supposed cubic foot and prevent it from entering. This is a somewhat crude explanation, but may serve to make clear why it is that a compressor with 100 cubic feet displacement per minute can take in only 70 cubic feet or so of cold gas in the suction pipe, since the 70 cubic feet of gas will expand in entering the cylinder so as to take up the whole 100 cubic feet of space. A cubic foot of gas at 10 pounds pressure in the hot cylinder would not weigh as much as a cubic foot of colder and denser gas in the suction pipe. If the same weight of gas were put into the cylinder, it would expand, and the pressure would increase to more than 10 pounds.

(12261) J. H. P. asks: Will you please inform me how scroll inlaid or marquetery work is done with thin wood veneers? What I do not understand is, if it is sawed with scroll saws, how the saw is inserted through the veneers without leaving a hole which would not fill with the inlay. A. All inlaid scroll work is done by jig-saws, which can be unfastened at one end and passed through a hole made in the line of the saw cut. The inlaid piece is sawed at the same time as the background, but the table of the saw is tilted so that the inlay is sawed slightly larger than the background. The tilt is made just enough so that the inlay fills up the saw cut or kerf. It only remains to provide for introducing the saw without making an unsightly round hole, and this may be done either by making the hole in the middle of the piece to be cut out, sawing to the edge and starting along the outline, and then fastening on the upper piece, which will form the inlay; or by starting the saw slot by a routing tool or very small drill whose diameter is equal to the width of the saw cut. Such a router could be fed down through the two thicknesses of wood, and then fed along the saw cut until a slot was made of sufficient length to admit the width of the saw blade.

(12262) J. M. D. asks: Some time ago I read about the danger of benzine, turpentine, and other oils from spontaneous combustion when used on cloth, cotton, and "waste" used to rub or brighten up woodwork, furniture, etc., and then laid away for future use: that fires have started from this source accidentally. The article mentioned a lady using benzine to brighten some furniture. She placed the cloth in a dresser drawer to be used next day, and it caused a serious fire. It also mentioned some painters throwing several bunches of cotton waste out in the sun saturated with turpentine. They made bets as to which would burn first while they ate dinner. A. We do not recall the particular article you have in mind, treating of the spontaneous combustion of oily rags, etc. It is a matter of common knowledge that oil rags may ignite after an uncertain period, if left in a mass; and insurance companies demand that fireproof cans shall be provided in all buildings where work is carried on involving the use of oily rags, into which discarded rags shall be thrown. On the other hand, it is very doubtful that any particular mass of rags will take fire in any reasonable time, and unless the sun was unusually bright, the chances are that your painters would sit long past their dinner hour waiting for their prepared rags to burn up spontaneously. The combustion occurs from one of two causes: the presence of some light vapor like gasoline, or the increase of the temperature in the mass of rags from fermentation of oil or organic matter accidentally introduced into the pile. Probably in most cases of supposed spontaneous combustion, pipe ashes, matches and rats, or cigar butts were the real causes. There have been cases where moderate heat, as from adjacent steam pipes, was the only possible cause of the ignition of the light vapor.

(12263) G. H. H. asks: I am not a scientist, but like all the rest, have been deeply interested in the movements of Halley's comet, and the accounts of it I have read in the SCIENTIFIC AMERICAN. As the tail failed to envelop the earth, but was deflected to one side, I wish to ask if it is not barely possible that the comet's tail was prevented from swishing over the earth, and turned from its course by the great revolving force of the earth, exerted upon, and carrying with it, the air and other gases? No one knows to how great a distance in space the revolving influence of the earth extends; but I believe if some one could have calculated the distance from the earth at which the comet's tail was deflected, the distance of the earth's force would be known. The deflection of the comet's tail by the revolving force of the earth would be on the same principle as holding a string by one end past a revolving fan; when it came into range of the fan's influence, it would be blown to one side. A. We have not heard from the astronomers as to their opinion why the tail of Halley's comet did not conduct itself as it was expected to do. It would seem evident, however, that there is no outflow of wind from the earth, due to the rotary motion of the earth, which could have whisked the tail around away from the earth, as a string would be whisked away from a rapidly revolving fan. The air of the earth is held in its place by gravitation, as are the solid rocks of the earth itself. We have an idea that the phenomenon may have been electrical, due to the air and the tail of the comet being similarly charged with electricity, but this is a mere conjecture where nothing is known.

(12264) R. S. T. asks: A certain book speaking of a thermometer says: "But it should not be exposed to repeated and violent changes, as that will spoil the best one in the course of time." Can you tell me in what way such "violent changes" can affect a mercury thermometer, provided of course the glass is not broken? A. We have no tables of occultations for stars from which we could tell you what star was occulted by the moon at the time you mention. You can doubtless obtain the information by addressing the U. S. Observatory, Mare Island Navy Yard, California. The astronomer there is Prof. See, and he will have the necessary data at hand. There is no change in the mercury of a thermometer to make it incorrect after exposure to a high temperature. The change is in the glass. Glass is a plastic substance, although highly brittle. A gradual change in volume takes place after it has been heated or melted. For this reason a thermometer should not be graduated for several months after it is filled and sealed up. If thus graduated it will be found that the readings are too high, since the glass has slowly shrunk. In the same way, if a thermometer has been heated to a high temperature and then is placed in a cold place, it will read too low, since its bulb has not had time to shrink to its normal volume. For this reason also the freezing point is first to be determined, and the boiling point is determined later.

(12265) W. H. F. writes: The actual weight of a body on a revolving planet is equal to the force of gravitation minus the centrifugal force. If the earth stopped revolving, would not all bodies weigh a great deal more? Can it be possible that the centrifugal force is greater (as exerted on some bodies) than the force of gravitation, thereby causing meteorites, etc., to fly off the planets? If this is so, is it not feasible to suppose that a square inch of aluminium is actually heavier than a square inch of lead?" A. A body weighs 1/289 less at the equator because of the rotation of the earth on its axis. At the poles this diminution of weight is zero. If the earth stopped its rotation, the weight would increase by this same fraction. If the earth rotated on its axis in 1/17 of a day, bodies at the equator would lose all their weight. If it rotated faster than that, they

would fly off into space. There is no reason from this for supposing that aluminium is heavier than lead, since if the two are weighed at the same place the lead weighs more than the same bulk of aluminium.

(12266) D. A. H. writes: Although it is a matter of not very great importance, don't you think that you have made some sort of arithmetical slip in your answer to query 12242? It looks as if your quotient in each case is too small, as the common test of multiplying the quotient and divisor seems to show. The algebraical solution of the question is very neat. If the circumference is increased by any amount a, the diameter will have a proportionate increase x.

Then $\frac{C+a}{D+x} = \pi$

Hence $x = \frac{C+a}{\pi} - D = \frac{C}{\pi} + \frac{a}{\pi} - D$

But $\frac{c}{\pi} = D \therefore x = \frac{a}{\pi}$

If $a = 18$ feet, then $x = 5.73$ feet.

A. It is a very great pleasure to receive so courteous a criticism. The difference referred to is probably due to the difference in the number of decimal places used by the different computers, as we said in the original note. If all would adopt and follow the rule used in laboratory computations in physics, results would be more accordant: Retain only the same number of decimal places in any result as are given in that number having the largest number of known decimal places, and discard decimal places beyond this number at each stage of the operations. It is easily shown that the retention of a larger number of decimals makes the result less, and not more, accurate.

NEW BOOKS, ETC.

ENGINEERING CONSTRUCTION IN STEEL AND TIMBER. By William Henry Warren. London and New York: Longmans, Green & Company, 1910. 8vo.; 472 pp. Price, $5.

The development in the science of testing materials, and the various researches undertaken during the last fifteen years, have supplied an enormous amount of data on the physical properties of the materials of construction. Wrought iron has been replaced by structural steel. The safe intensity of working stresses in structures subjected to moving train loads is now considered to be best determined by means of an equivalent dead load, equal to the live load increased by an amount representing the impact effect, added to the dead load, in preference to the so-called fatigue formulæ for working stresses. It has therefore necessitated rewriting the first two chapters of the book. A cursory examination gives the idea that it is a thoroughly valuable treatise which will be of the greatest assistance to engineers, particularly for the design of roofs, bridges, viaducts, beams, columns, etc. The book is very well made and has a number of excellent folding plates.

THE ART OF AVIATION. By R. W. A. Brewer. London: Crosby, Lockwood & Son. New York: McGraw, Hill Book Company, 1910. 8vo.; 253 pp. Price, $3.50 net.

This is a handbook upon aeroplanes and their engines, with notes upon propellers. It is one of the most thoroughly satisfactory books upon scientific aeroplane construction which has ever been put on the market. The author has assembled a vast array of facts and figures bearing upon the construction of aeroplanes, their engines and propellers. There are comparative tables of prominent machines of immense value. Thus we have one table which gives the name, the type, the maker, the number of propellers, the supporting areas, the length, the span, the maker of the engine, the type, the horse-power, the weight of the flyer without the pilot, and the price in francs. The book is beautifully printed on coated paper, and it is accompanied by twelve valuable folding plates illustrating various types of machines and motors.

ITALIAN HIGHWAYS AND BYWAYS FROM A MOTOR CAR. By Francis Miltoun. Boston: L. C. Page & Co., 1910. 12mo.; 380 pp. Price, $3.

The author has written a number of books dealing with travel in Europe. Among his other writings are "Rambles on the Riviera," "Rambles in Normandy," "Rambles in Brittany," etc. The present volume contains a number of illustrations from the pen and brush of Blanche McManus. The maps are particularly valuable, as they are on a good scale and give the distances in kilometers. The book is printed on a delicately tinted paper, and it is appropriately bound.

SICILY, THE GARDEN OF THE MEDITERRANEAN. By Will S. Monroe. Boston: L. C. Page & Co., 1909. 12mo.; 405 pp. Price, $3.

The author deals in an interesting way with the history, people, institutions, and geography of the island. The aim of the author has been to interest the general reader of travel and description, to inform prospective tourists to the Garden of the Mediterranean, and to refresh the memories of those who may have already made the tour. In this, as in his other books of travel, the author has placed special emphasis on the distinctly human side of the subject, and, while not including the discovery of the island and its diverse physical features, it has been, after all, the Sicilians themselves—their manners, customs, habitations, and institutions—that have received the lion's share of the book.

OBERAMMERGAU, ITS PASSION PLAY AND PLAYERS. By Louise Parks-Richards. Munich: Piloty & Loehle, 1910. 16mo.; 223 pp.

The Passion Play season of 1910 is resulting in the production of a whole literature relating to the play. This book is one of the best which we have had the pleasure of reviewing this year. The only criticism which we have to make is that the proofreader was not always very sure of his English spelling. Errors of this kind always mar even the best book. Thus, on page 94, we find the word "stage" spelled with two a's. There are a number of the illustrations which we have never seen reproduced anywhere, and show intimately the life and character of the actors. Some of the pictures of the children are particularly charming. The commercialization of the Passion Play is always an interesting point. Has the Oberammerguan not degenerated into a mere speculating business man, and has the Passion Play not come to be a means for furthering his money-making schemes? These are questions which are agitating the traveling public as they did the traveling public ten or twenty years ago. As a matter of fact, the total receipts for 1900 were only $267,171, of which $102,512 went to the performers and $83,686 went for public improvements. This does not show that the actors are getting very rich for their sacrifice of a whole summer's work. The principal actors receive only about $375 for forty-seven performances, so that this rather exceptional type of talent does not seem to be overpaid.

SELF-TAUGHT MECHANICAL DRAWING AND ELEMENTARY MACHINE DESIGN. By F. L. Sylvester, M. E. With additions by Erik Obero, Associate Editor of Machinery. New York: The Norman W. Henley Publishing Company, 1910. 12mo.; 230 pp. Price, $2.

This treatise conveys the first principles of geometric and mechanical, workshop mathematics, mechanics, strength of materials, and the calculations and design of machine details, including cams, sprockets, gearing, rivets, bolts, belting, couplings, screws, pulleys, clutches, flywheels, etc. The book is well made, but a criticism which will be quickly made on it is that it devotes more attention to elementary machine design than it does to mechanical drawing. Perhaps if the title had been reversed, the true contents would be disclosed more accurately.

DIE WELT DER PLANETEN. By Dr. M. Wilhelm Meyer. Stuttgart: Kosmos Gesellschaft der Naturfreunde, 1910.

This is the latest of the little science monographs published by the well-known Kosmos Gesellschaft der Naturfreunde. In it Dr. Meyer deals very simply, and yet very thoroughly, with the phenomena of the planets.

DICTIONARY OF METALLURGICAL AND CHEMICAL MACHINERY, APPLIANCES, AND MATERIAL MANUFACTURED OR SOLD BY ADVERTISERS IN METALLURGICAL AND CHEMICAL ENGINEERING. New York: Metallurgical and Chemical Engineering, 1910. 219 pp. Price, 50 cents.

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- Last jack, L. Hackett 963,140
- Latch, C. E. Lowe 963,450
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- Ointment applier, R. A. Kooken 963,051
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SOLVING PROBLEMS OF NAVIGATION.

(*Continued from page 44.*)

must solve the spherical triangle; and although the problem has been simplified by means of formulæ, nevertheless errors are liable to creep in.

This is a calculation which the navigator is most frequently called upon to perform, but is not by any means the only problem in spherical trigonometry that he must solve; and to assist him in this work, a new mechanical device has been invented, whereby the navigator may avoid all calculations and obtain the answer to his problems by direct reading on a series of graduated circles. Navigators who have borne with us thus far in our elementary explanation for the benefit of laymen, will be interested to learn that the new instrument, or "mechanical navigator," as it has been called, will solve directly and simultaneously the two, and sometimes three, spherical triangles involved in finding a ship's position from two star or sun sights, making it possible to determine the ship's position without previous knowledge of its latitude.

The instrument is a mechanical reproduction of the diagram shown in Fig. 1. In the drawing, Fig. 2, we have the horizon circle *HAR*, the altitude circle *ASZ*, the meridian circle on which the declination is marked *POD*, and the celestial equator *EOQ*. The horizon circle is mounted in a yoke *C* on an axis which points east and west. At right angles to the plane of the horizon circle is a rod *F*, terminating at *Z*, which indicates the zenith. The altitude circle *ASZ* consists of two quadrants, which are mounted on the rod *F*. The meridian circle *POD* is mounted on an axis at right angles to that of the horizon circle, and the ends of this axis represent the north and south celestial poles. In order to reproduce the diagram, Fig. 1, the circle representing the celestial equator should intersect the meridian circle on the axis of the horizon circle; but for purposes of convenience it has been placed to one side, and the points where the meridian circle intersects the equator are projected on the latter by the two vernier markers *G*, mounted on extension arms rigid with the meridian circle. The horizon circle may be tipped on its axis to represent different latitudes, and to enable this to be done with accuracy, it is fitted with a sector *I*, which may be clamped at the desired position. A pair of thumb screws *J*, provided with conical points are arranged to give a micrometer adjustment of this circle. The altitude circles are provided with vernier markers *M*, and the meridian circle with vernier markers *N*. There is also a vernier marker *K*, to permit of accurate adjustment of the equatorial circle *EOQ* when it is operated by the slow-motion screw *V*. In use, the horizon circle is tipped to such an angle that the distance between the point *Z* and the intersection of the polar axis with the meridian circle will represent 90 deg. minus the latitude. The altitude of the sun circle or other body upon which an observation is made is accurately indicated by a marker *M* on the horizon circle, while the declination of the body is taken from the Nautical Almanac, and is indicated on the meridian circle by a marker *N*. The meridian circle and the altitude circle are then revolved to make their markers coincide, when the hour angle may be read directly on the equatorial circle *EOQ*.

We have already stated that the altitude circle consists of two quadrants. The meridian circle is also made up of two parts, each hinged on the polar axis. This permits of making two observations and solving two triangles at the same time. The two stars on which observations are made are marked by two markers *M*, one on each quadrant of the altitude circle. The declination of each star is also marked on the meridian circle, by using two markers *N*. The two sections of the meridian circle can then be separately moved to coincide with the

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Pocket knife, unfolding, J. Feinenburg 963,428
Powder receptacle, Dunwoodie & Dunwoody. 963,214
Power transmission mechanism, Golden & Kendall 963,138
Power transmitting mechanism, fluid controlled, A. Sundh 963,092
Precious metal bearing materials, treating, Avery & Knowles 963,111
Pressure apparatus, automatic control for, H. F. Thoma 963,662
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Pulling jack, W. Sylvester 963,095
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Pump, F. S. Dickinson 963,528
Pump, centrifugal, H. Legros 963,593
Pump, duplex spray, M. T. McCarty 963,626
Pump, high-pressure turbine, W. L. Forward 963,539
Pump, lamp, J. F. Lamb 963,228
Pump, rotary, F. J. Curtis 963,690
Pump to lift water, gas, Mico y Munoz 963,167
Pumping apparatus, X. Caverno 963,358
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Pumping machine, automatic, W. M. Myers 963,058
Purse, coin, O. E. Allen 963,494
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Radiator hanger, wall, A. Kehm 963,580
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Rail bond, C. L. Cadle 963,356
Rail chair and brace, combined, G. A. Johnson 963,294
Rail joiner, Ladvigsen & Sveistrup 963,718
Railway cross tie, J. Gearen, Sr 963,542
Railway crossing, F. Stitzel 963,258
Railway frog, Reinoehl & Henderson, 963,325, 963,326
Railway rail fastener, J. B. Barnes 963,031
Railway spike, O. J. McKnight 963,312
Railway spike, O. L. Simon 963,330
Railway switch device, automatic, R. Y. Partida 963,642
Railway tie, composite, B. F. Wise 963,196
Railway track construction, L. H. Evans 963,364
Raisin seeder, Erlenbach & Kohn 963,702
Rake and stalk cutter, combined, W. Mercer 963,455
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Reciprocating die, F. Richardson 963,394
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Refrigerating or cooling apparatus, G. Hildebrandt 963,555
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Rein holder, R. C. Murdock 963,622
Relay, I. Kitsee 963,374
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Rheostat, liquid, F. Mackintosh 963,163
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Riffle for concentrating tables, A. M. Kemp. 963,582
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Safe door, bank, G. M. Mercer 963,236
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Salt and pepper holder, J. T. Stapleton 963,333
Sand drying apparatus, H. C. Freeman 963,133
Sandpapering machine, G. Smith 963,481
Sash fastener, N. O. Booth 963,504
Saw, J. W. Costello 963,520
Sawing and mitering machine, J. Dyer 963,697
Scarf pin holder, R. Fischer 963,537
Scouring, grinding, and polishing machine, Service & Emley 963,477
Scraper, F. W. McLean 963,630
Scraper, hand hole, Cockrell & Miller 963,421
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Seeder, hand, J. F. Rittenhouse 963,067
Sewing machine presser foot, G. S. Gatchell 963,135
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Sheet metal box, A. E. Blackman 963,352
Ships and other places, apparatus for discharging ashes, ballast water, bilge water, and other materials from, G. C. Ralston 963,649
Shock absorber, C. Swan 963,094
Shock absorber, pneumatic, A. Means 963,606
Shoe and boot, M. Mannesmann 963,605
Shoe tree, J. S. Hansen 963,370
Sign, wind operated revolving, J. Meyers 963,165
Signal switch, electric, J. I. Ayer 963,728
Silo feeder, J. J. Kennel 963,583
Skein and holder therefor, J. G. Smith 963,084
Sled, F. A. Miller 963,615
Slicer, bread, V. Larson 963,300
Slimes, apparatus for the treatment of metal-bearing, C. H. Jay 963,710
Smoke preventer, L. H. Long 963,602
Smokestack, E. T. Jenkins 963,208
Smoking pipe, S. P. Etter 963,038
Snap hook, W. A. Schleicher 963,475
Snow plow, P. Hannagan 963,369
Soap slabbing machine, C. W. Aiken 963,413
Sound recording or reproducing apparatus, T. A. Edison 963,362
Spade, tiling, F. J. Vondracek 963,668
Sparking device, C. H. Stonebridge 963,334
Spike, toothed, H. O. Crippen 963,280
Splint cutting machine, A. H. Hall 963,141
Spraying apparatus, W. G. R. Braemer 963,354
Spring wheel, P. J. Hovland 963,565
Spring winding device, S. Butterworth 963,512
Sprinkler, W. Storey 963,089
Sputum cup and holder therefor, C. W. Meinecke 963,454
Square, geometrical miter, W. Bundy 963,274
Stamp, hand, G. W. Walters 966,340
Stanchion, E. A. Hoeffel 963,149
Stand. See Dressmaker's fitting stand.
Stand, F. J. Selden 963,658
Steam generator for cooking purposes, W. L. Dunn 963,695
Steam meter, F. E. Pendleton 963,643
Steam superheater, E. H. Foster 963,732
Steel, manufacture of, A. Reynolds 963,652
Steering apparatus, A. Sundh 963,090
Steering gear apparatus, A. Sundh 963,091
Steering wheel, A. G. McPherson 963,240
Sterilizer and water heater, combined, E. G. Stamper 963,726
Stitch-forming mechanism, Theisen & Keller 963,486
Stock fountain, H. C. Johnson 963,578
Stoker, mechanical, W. M. Duncan 963,532
Stone, artificial, T. M. Thom 963,337
Stove, camp, S. E. Balch 963,030
Stove, cooking, H. H. McMaster 963,631
Stoves, gas or vapor, A. F. Bauer 963,266
Strainer or separator, H. E. Morley 963,462
Suction cup, E. Noppel 963,060
Superheating boiler, A. B. Stirling 963,257
Suspenders, H. H. Small 963,083
Suspending device, suction, C. A. Austin 963,264
Switch box and support, combined, J. J. Odenwald 963,315

(Concluded from page 56.)

altitude circles, and the two vernier markers *G* will indicate the hour angles on the equatorial circle, while the inclination of the rod *F* will indicate the latitude of the ship.

When making two separate sun sights, a separate marker *M* is provided to represent the zenith point at the first observation, and a spherical compass, which is similar to the ordinary drawing compass except that the arms are curved, is employed, making it possible to solve all three triangles at once. The latitude of the vessel is then determined by the inclination of the axis *F*.

The instrument has been very carefully calibrated, and is provided with every refinement of adjustment, whereby it is possible to make correct readings within fifteen seconds of arc, which is well within the requirements of navigation. We are informed that the instrument has received the approval of the British Admiralty, and is now being tested by our own naval observatory, so far with very gratifying results.

We are indebted to the makers of the instrument, F. E. Brandis, Sons & Co., for the foregoing particulars and photographs.

RADIUM COLLECTOR FOR ELECTRICITY.

(Concluded from page 44.)

lector is shown connected to an electric bell, the discharges of the electroscope being indicated by the ringing of the bell. In this case there is an ordinary type of coherer and relay in series with the bell, so that the signals are of short duration, or a chime of bells can be connected to the electroscope and a continuous playing of the chimes thus obtained. For meteorological purposes a recording drum is attached and the discharge recorded on a continuous roll of paper either by stylus and ink or by a photographic agency to secure time records.

The apparatus is particularly useful for giving warning of the approach of an electrical disturbance in the atmosphere such as a magnetic storm or a thunderstorm. In the case of the latter its approach is indicated long before the disturbance reaches the point at which the collector is set up, the discharges from the electroscope being very heavy, and increasing in frequency and power as the storm approaches. By following the indications of the warning thus extended, it is possible to trace the course of the pending storm, and to ascertain whether the disturbance will deviate to one side or the other of the observing station, or burst over it. The discharges under normal conditions of fine weather are invariably positive, changing over to negative before a storm. The apparatus has the advantage of being very simple and so designed as to be immune from breakdown. Once set up, the electrical state of the atmosphere is shown continuously, and in such permanent installations that it is only necessary to bring the fine wire from the collector into the house or room to the point where the electroscope and other apparatus are established, through a small hole in a window frame or wall, in exactly the same way as with a telephone or electric bell wire.

SAFETY APPLIANCES IN COTTON SPINNING.

(Continued from page 45.)

trap—a fearful one, too. The next worker who attends the machine to clear away the curtain is caught by hundreds of these wire points, and the hand is drawn between the cylinder and doffer plate. All soft parts of the hand are gnawed away by the revolving wires, the general result being loss of the hand or arm.

Efforts are now directed toward avoiding this casualty by fitting locking arrangements to cards, so that the stripping door cannot be opened until the cylinder is quite stationary; and no restart can be effected until the door is firmly closed.

Accidents on draw frames, which follow the cards, have been practically elim-

(Concluded on page 58.)

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 10 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. **In every case it is necessary to give the number of the inquiry.** Where manufacturers do not respond promptly the inquiry may be repeated.

MUNN & CO., Inc.

BUSINESS OPPORTUNITIES.

Inquiry No. 8918.—For manufacturers of "Wydt s Electro-Catalytic Sparking Plug."

AGENCY WANTED, for a good American Wood Box Stitching and Hinging Machine by a firm of long standing in box making machinery. Write Box 888, care of Lee & Nightingale's Advertising Offices, Liverpool, Eng.

Inquiry No. 8987.—Wanted, the manufacturers of the Van Winkle Woods & Sons, and the Weber power meters.

FOR SALE.

PRESSURE MILKING MACHINE, the latest and best system of milking cows. No. 96841. For particulars inquire to B. J. Bigelow, 702 S. 9th Street, La Crosse, Wis.

Inquiry No. 9014.—For manufacturers of machinery, supplies, etc., to equip a small plant for the manufacture of iridium-tipped gold nib making for fountain pens.

PATENTS FOR SALE.

FOR SALE.—Outright or on royalty, an automatic lock for miners safety lamps. Simple, can not be picked. For particulars address Anson Hall, Johnstown, Pa.

Inquiry No. 9016.—Wanted, machinery necessary for an installation of a plant for refining salt by a modification of the Bessemer process.

FOR SALE.—Foreign patents. U. S. patent allowed, license. Valuable improvement in trunk, no trunk complete without. For particulars address, Joseph Popenhagen, 1342 W. Munroe Street, Chicago, Ill.

Inquiry No. 9029.—Wanted, catalogues and all information on machinery for braiding straw in manufacturing straw hats.

WANTED.—Name and address of responsible manufacturers who would contract manufacture of automobile jack; recent patent. Might consider royalty proposition. E. I. Spencer, Room 312, Barnes Blk., Wichita, Kans.

Inquiry No. 9038.—Wanted, the address of the Chipman Electric Purifying Co.

WANTED, to sell patent on rotary or dash churn. For any further information address Marugg Bros., 255 Galipago Street, Denver, Colo.

Inquiry No. 9060.—Wanted to buy machinery to manufacture seed corn racks.

FOR SALE.—The rights of a device for stopping the blades of the "Gillette" Safety Razor. Ready for the market and being manufactured upon the most economical terms. Further information, half-tone reproductions and sample instrument sent gratis, upon request. J. P. Laker Co., Box 188, Victoria, B. C., Canada.

Inquiry No. 9075.—Wanted, to buy small weather vanes, such as can be used as ornaments on lightning rod tops. Aluminum preferred.

ADVERTISING novelty for sale including patent, not yet on market. Good income assured. Small capital. Will stand investigation. Novelty, Box 773, New York.

Inquiry No. 9076.—Wanted, the address of parties in Canada who could make a safety razor.

LISTS OF MANUFACTURERS.

COMPLETE LISTS of manufacturers in all lines supplied at short notice at moderate rates. Small and special lists compiled to order at various prices. Estimates should be obtained in advance. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9078.—Wanted, the address of manufacturers of sewer pipe, made of fiber and asphaltum, suitable for laboratory use.

SALE AND EXCHANGE.

A LIST OF 1,500 mining and consulting engineers on cards. A very valuable list for circularizing, etc. Price $15.00. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9094.—Wanted address of The Thomas Arithometer Company, also Burkhart Arithometer Company.

Inquiry No. 9096.—Wanted, the address of manufacturers of spiral welded pipes, possessing great strength.

Inquiry No. 9097.—Wanted, address of makers of impulse water wheels.

Inquiry No. 9099.—Wanted, address of manufacturers of machinery for making wire cables.

Inquiry No. 9107.—Wanted, addresses of manufacturers of small emery files (pieces of emery in the shape of a file).

Inquiry No. 9109.—Wanted addresses of the manufacturers of the Dion Desk Clock.

Inquiry No. 9113.—Wanted name and address of the manufacturers of the Russell Patent Automatic Ink Well.

Inquiry No. 9115.—Wanted a machine for making pen nibs, similar to Wm. Mitchell's G. & J. nibs and Waverly nibs.

Inquiry No. 9120.—Wanted, the address of the Ideal Fuel Feeder Co.

Inquiry No. 9134.—Wanted, a small hydraulic motor, capable of giving about one horse power, with a water power of 35 lbs. per square inch.

Inquiry No. 9136.—Wanted, the name and address of a skunk raising farm.

Inquiry No. 9137.—Wanted, a device that will braid leather strips for horse whips.

Inquiry No. 9138.—Wanted, the address of manufacturers of machines capable of forming a number (12 or more) of pieces of paste about 36 mm. x 32 mm. x 6 mm., made of lead oxide and sulphuric acid, and placing them into a frame having a separate compartment for each piece, the space between each piece and the next being all round 4 mm. The process could be somewhat similar to biscuit making.

Inquiry No. 9140.—Wanted, manufacturers of disc records for gramaphones that use a sapphire point instead of a steel needle.

Inquiry No. 9143.—Wanted, name and address of the manufacturers of an air mattress.

Inquiry No. 9144.—Wanted, manufacturers of machinery for making soda water tubes, commonly known as straws.

Inquiry No. 9145. Wanted, to buy machinery to load blasting caps or detonators.

Inquiry No. 9152.—Wanted, the address of the Graham Safety Lamp Filler and Ventilator.

Inquiry No. 9153.—Wanted, name and address of manufacturers of a knotless clothes line.

Inquiry No. 9155.—Wanted, the address of manufacturers of an electric milking machine.

Inquiry No. 9163.—Wanted, manufacturers of a cradle worked by clock work.

Inquiry No. 9167.—Wanted, the address of the German Quartz Co.

Inquiry No. 9168.—Wanted, the name of manufacturer making the Morse Eureka Spring Terminal, sometimes called spring clip.

Inquiry No. 9169.—Wanted, the address of the manufacturers of the Hornsby Akroid 85 H. P. Gas Engine.

Inquiry No. 9170.—Wanted, manufacturers of a movable apparatus for the distillation of wood stumps.

Inquiry No. 9172.—Wanted, the address of the Arnold Vacuum or Suction Cleaner.

Inquiry No. 9173.—Wanted, manufacturers of machinery for removing fibre (coir) from cocoanut husks.

Inquiry No. 9174.—Wanted, improved fabric suitable for airships. Lightness and breaking strain must be exceptional.

Inquiry No. 9175.—Wanted, manufacturers of a machine called Belasco or Blasco, used in the manufacture of ostrich feathers.

Inquiry No. 9176.—Wanted, the address of E. R. Holmes Motor Company, manufacturers of a rotary aeronautic motor.

Inquiry No. 9177.—Wanted, the address of parties owning talc deposits.

Inquiry No. 9178.—Wanted, the address of L. E. Crandall & Co., manufacturers of a small suction cup rubber hat rack.

Inquiry No. 9179.—For manufacturers of complicated mechanism such as adding machines, typewriters, etc.

Inquiry No. 9180.—Wanted, manufacturers of a device for cutting weed under water.

(Concluded from page 57.)

inated since gear wheels were incased. Speed frames, on the other hand, are the cause of many an accident. This comes chiefly from cleaning dangerous parts while the frames are in motion. The skew bevels operating the bobbins and spindles are necessarily guarded on all sides, with the exception of the lower portion of the bobbin wheels. Were this fencing omitted, accidents on these frames would be intensely serious. The driving wheels too are now fenced after a new idea; in place of each individual wheel having its own guard, automatic locking doors are fixed to the machine, which bar any admission to the wheels when running.

From speed frames to the mules is a natural step. Here the final touches are given to the yarn by a machine which displays the acme of inventive genius. Yet of all the machines in a cotton-spinning establishment, none produces such frequent casualties as the mule. The children and youth who "piece" the threads as they snap during the process of stretching and twisting, have fingers crushed under faller hammers and carriage wheels, while more serious casualties come from unfenced quadrants and headstocks.

Fortunately for these young people, practical guards are now constructed which very materially minimize their risk, and make their daily employment much safer than formerly.

Headstocks are now protected by complete guards, which inclose all moving factors. Carriage wheels have guards fitted between the wheel and slip rail. Faller hammers rise and fall inside a fixed hood. Quadrants and pinions have their covers, which afford ample precaution against injury; while scroll wheels on the back shaft, where so many boys have come to grief with a lost arm, are so guarded that only by meddling can casualties occur.

PHOTOGRAPHING PROJECTILES IN FLIGHT.

(Continued from page 51.)

the firing of the automatic pistol and the moment it is ready for the next shot. If these pictures are then thrown upon a screen slowly by means of a cinematograph, we can follow every movement of the pistol mechanism, the shot, the ejected cartridge, and observe the powder gases, the leakage at the breech, and even the scattering of the unconsumed powder gases. The author became acquainted with the truly marvelous Cranz method as the result of an invitation issued in May of this year by the ministry of war to the members of the congress of ballisticians. As Privy Councilor Cranz in-

(Concluded on page 59.)

Switch stand, F. E. Place ... 963,646
Syringe, vaginal, I. L. Stevens ... 963,482
Syrup dispensing mechanism, L. A. Becker ... 963,268
Table, extension top, knockdown, F. B. Walter ... 963,190
Table leg locking device, C. C. Hastings ... 963,439
Talking machine attachment, W. A. Chapman ... 963,515
Talking machine sound box, L. T. Haile ... 963,546
Tanks, constructing bent-wood, D. F. Whitmore ... 963,491
Tap, beer, Quigley & Beck ... 963,323
Target trap, H. E. Winans ... 963,347
Taximeter, A. J. B. E. Darras ... 963,281
Telegraph apparatus, R. L. Dean ... 963,213
Telegraph system, secret, W. P. Phillips ... 963,062
Telegraphic relay, I. Kitsee ... 963,298
Telephone and control system, combined, H. G. Webster ... 963,192
Telephone receiver attachment, G. S. McComb ... 963,628
Telephone wire hanger or support, F. W. Morse ... 963,056
Temperature regulating system, W. A. Sheldon ... 963,255
Threshing machine, H. T. Seburn ... 963,080
Tire, I. F. Peck ... 963,320
Tire fastener, R. W. Jordan ... 963,048
Tire protector, pneumatic, G. Vergote ... 963,667
Tire, wheel, C. E. Blechschmidt ... 963,271
Tobacco pipe, H. E. Whitney ... 963,194
Toilet or vanity box, S. Davis ... 963,212
Tongues, spring support for wagon, E. Foerster ... 963,704
Tool, combination, J. C. Dikes ... 963,124
Tool holder, H. B. Robinson ... 963,068
Tool holder, B. M. W. Hanson ... 963,144
Tooth and crown, artificial, C. W. Plumley ... 963,648
Tooth, artificial, R. Galloway ... 963,541
Torsiometer, F. T. Edgecombe ... 963,699
Toy, automatic reversing motor, Kingsbury & Kidder ... 963,715
Transformer, three-phase, J. J. Frank ... 963,132
Trap. See Animal trap.
Tray, wheeled, J. N. Stewart ... 963,404
Trimming-cutting machine, D. Maus ... 963,453
Trolley, C. Paull ... 963,387
Trolley, W. W. Hutchingson ... 963,571
Trolley wire ice remover, Brown & Doyle ... 963,205
Trolley wire splicer, Griswold & Kerin ... 963,288
Trowel, adjustable, R. W. Linville ... 963,717
Truck for carrying radiators, J. L. Welshans ... 963,410
Truss, C. Pence ... 963,469
Tub waste pipe, laundry, G. S. Winant ... 963,101
Tube cutter and reamer, K. Mathews ... 963,610
Tunnel support, Finlayson & Cain ... 963,536
Turbine, elastic fluid, R. F. Halliwell ... 963,142
Turbine, elastic fluid, R. H. Rice ... 963,178
Turbine governing mechanism, F. Samuelson ... 963,074
Turbine governing mechanism, C. H. Worsey ... 963,107
Turbine governing mechanism, A. S. Anderson ... 963,110
Turbine or centrifugal pump, H. Lorenz ... 963,378
Turbine, wind, J. G. Childs ... 963,359
Turbines, system of lubrication of elastic fluid, O. Junggren ... 963,154
Turning irregular forms, machine for, A. Lehmann ... 963,594
Turning irregular forms, machine for, H. F. Loewer ... 963,601
Turpentine cup, G. C. Pringle ... 963,065
Turpentine cup support, G. C. Pringle ... 963,066
Twine, cord, and the like ball, C. Berry ... 963,114
Type holder, rubber, H. S. Folger ... 963,365
Type setting and distributing machine, J. S. Duncan ... 963,692
Typewriting machine, E. H. Berry ... 963,269
Typewriting machine, G. A. Seib ... 963,328
Typewriting machine, H. S. McCormack ... 963,629
Typewriting machines, calculating attachment for, E. C. Walter ... 963,727
Umbrella, folding, E. H. Newmeyer ... 963,634
Umbrellas, canes, etc., box for, W. H. Beehler ... 963,351
Urinal slab, F. F. Rowell ... 963,472
Vacuum cleaner, Ericsson & Thoreen ... 963,701
Vacuum cleaning apparatus, E. W. Pierce ... 963,723
Valve, Jones & Gibson ... 963,152
Valve, L. W. Eggleston ... 963,215
Valve, J. Nolan ... 963,314
Valve, O. E. Oleson ... 963,385
Valve, float, J. L. Mayfield ... 963,305
Valve, flush, J. H. Mahoney ... 963,231
Valve for compound engines, starting, W. I. Kovalsky ... 963,375
Valve for wind instruments, E. K. Blessing ... 963,272
Valve, gas engine suction, H. F. Mueller ... 963,463
Valve, internal-combustion engine, D. V. T. A. Locke ... 963,600
Valve, siphon, F. Lutz ... 963,604
Valves, means for controlling the valve movement of gate, D. Libby, Jr. ... 963,230
Vault, burial, Brown & Bennett ... 963,115
Vehicle brake, R. N. Martz ... 963,608
Vehicle, canopy top, C. E. Walters ... 963,698
Vehicle emergency brake, H. F. Dietz ... 963,361
Vehicle, motor, G. W. Mascord ... 963,609
Vehicle wheel, W. W. Macfarren ... 963,304
Ventilating apparatus, W. Clifford .. 963,277, 963,278
Ventilating apparatus, S. V. Laughinghouse ... 963,590
Ventilator. See Window ventilator.
Vessels, apparatus for raising sunken, N. Nelson ... 963,168
Voting machine, L. R. Winslow ... 963,105
Voting machine auxiliary interlock, L. R. Winslow ... 963,104
Wagon brake, O. Hill ... 963,558
Wagon, dumping coal, T. E. Bond ... 963,503
Wagon hoist or lift, R. G. Roulstone ... 963,397
Walls, ceilings, etc., construction of tiled, G. N. Metzer ... 963,456
Washing and other machines, squeeze roll for, F. L. Furbush ... 963,540
Washing machine, E. C. Brown ... 963,116
Watch, eight day, J. F. Sandoz ... 963,398
Water closet bowl, vented, J. F. Kelly ... 963,297
Water closet connection, J. J. Cosgrove ... 963,688
Water heater, L. C. Rhea ... 963,177
Water heater, W. E. Beilman ... 963,415
Water heater, H. W. Donaldson ... 963,424
Water power plant, C. A. Nobis ... 963,241
Water purifier, F. Dinghaus ... 963,529
Water sprinkler, J. M. Alden ... 963,199
Weighing machines, compensator for, S. G. Murray ... 963,623
Well drilling apparatus, L. Schultz ... 963,657
Well screen, W. Harmon ... 963,549
Welts, machine for operating upon, J. B. Hadaway ... 963,708
Wheel. See Ball-bearing wheel.
Whiffletree connection, J. H. Whan ... 963,411
Whip lock, J. A. Frazer ... 963,286
Windmill, M. S. Swanstrom ... 963,335
Window construction, A. J. Ellis ... 963,363
Window or door screen, A. Miller ... 963,054
Window screen, W. L. Kane ... 963,373
Window screen, E. Riback ... 963,393
Window ventilator, J. X. O'Meara ... 963,637
Windows, screens, etc., device for hanging storm, E. C. Brown ... 963,417
Wire coiling machine, C. Wright, Jr. ... 963,197
Wood smoothing machine, J. A. Crismore ... 963,523
Wrapper or receptacle, A. W. Nack ... 963,313
Wrench, B. Goodman ... 963,287
Wrench, R. E. Harshell ... 963,550
Wrench, W. E. Elliott ... 963,700
Zinc, extraction of, C. S. Brand ... 963,416
Zither, J. Krienitz ... 963,588

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

(*Concluded from page 58.*)

tends to publish detailed information concerning the arrangement of the apparatus and the pictures produced, I shall not enter into this any further here. I will close by giving a brief sample of the wonderful results obtained with Cranz's method.

The cinematograph began to work in the darkened lecture room of the military academy. We see a pig's bladder, filled with water, suspended by a thread. The lecturer calls our attention to the fact that a projectile is approaching the bladder from the right at a speed of about 1,000 yards a second. On one of the following pictures the small projectile becomes visible at the margin upon the right. We then see how this little object gets nearer and nearer to the bladder, strikes it suddenly and vanishes in it. At the same time a huge cloud of powder follows the projectile. A very small quantity of water spurts from the bladder at the point of impact. The bladder itself hangs perfectly still on its thread. In the meantime the projectile has passed through the water contained in the bladder, strikes the bladder wall on the opposite side and carries the elastic bladder with it for a considerable distance. At this stage it seems as if it was not the projectile, but a long human finger which grows out of the bladder. Suddenly, however, the bladder's limit of elasticity is exceeded, the substance tears and the small projectile reappears, moving away more and more to the left in the succeeding pictures. The skin of the bladder does not spring back to its former position, as might be expected, but is kept horizontal in tube-like form, by the water rushing after the projectile. At the same time an additional amount of water squirts from the opening made by the projectile where it entered the bladder. The cloud of powder has come nearer and nearer to the bladder and, in conjunction with the spouting water, gradually obscures the entire image.

The photography of projectiles, indicated here in its principles, certainly is one of the most interesting and truly marvelous achievements which photography has accomplished in the last few years. In its further development it will no doubt yield still more remarkable results.—Techno-Photographisches Archiv.

How Much Light is Absorbed by Paper Hangings and Their Like?

A late issue of Die Bauwelt says the color of paper hangings and tapestry is far from being a factor of minor importance in the degree of light that prevails in a room, and is very closely related to the economic use of artificial illumination also. In accordance with their color, such fabrics throw back into the room a part of the light that is falling upon them while they annihilate another part, or absorb it, as the technical phrase is. As the power of absorption of light rises in such a fabric, so naturally in less degree is the room brightened and less advantageous is the use of artificial illumination, a part of the money spent for the latter being wasted for light annihilated by the hangings.

The latest investigation reveals that the absorption of light depends, in the first instance, on the color of the hangings, and therefore on the same color when the walls are painted with it, too. Naturally the most favorable effect of color in this regard is afforded by the white hangings and paints, but even these absorb 50 per cent of the light falling upon them, while the other 50 per cent radiates back into the room. Following these in the effect of light come the yellow hangings, which radiate 45 per cent and annihilate 55 per cent. The next in order are the bright green, of which the power of absorption rises to 60 per cent, while 40 per cent of the light striking them is thrown back. Dark green and red hangings exercise precisely the same influence; they annihilate quite 85 per cent, only 15 per cent radiating from them.

Field Glass Facts

that will interest you are told in Catalog No. 25, describing the line of

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The Masterpiece of Optical Mechanism, and the Most Powerful Glass at the Price.

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Samples (5 sizes) free on request.

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Philadelphia

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A veritable edition de luxe among railroad pamphlets has been issued by the Grand Trunk Railway System to proclaim amongst tourists the glories of the cities of Montreal and Quebec. The brochure is beautifully printed and generally arranged in the artistic style of earlier days, when the ornamentation of a volume was regarded as an important incident to its presentation of reading matter. It gives an interesting description of the two most interesting cities in Canada, with many illustrations from photographs. Sent free to any address. Apply to F. P. Dwyer, 290 Broadway, New York.

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Dr. Jekyll and Mr. Hyde At the Telephone

Courteous and considerate co-operation is as essential at the telephone as in the office or home.

In every use of the telephone system, three human factors are brought into action—one at each end, one or both anxious and probably impatient, another at the central office, an expert, at least as intelligent and reliable as the best stenographers or bookkeepers.

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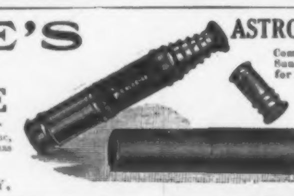

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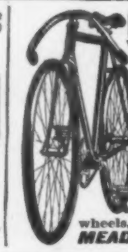

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